INITIAL STUDY AND ENVIRONMENTAL REVIEW CHECKLIST

California Environmental Quality Act (CEQA)

PROJECT INFORMATION

1. Project Title: Old Durham Wood, Inc. Conditional Use Permit (UP18-0002). Amendment No. 3 to Condition Use Permit UP14-0002 and UP15-0005.

2. Lead Agency Name and Address: Butte County – Department of Development Services
Planning Division
7 County Center Drive
Oroville, CA 95965

3. Contact Person and Phone Number: Rowland Hickel, Senior Planner
530.552.3684
rhickel@buttecounty.net

4. Project Location: The project site is located at 1156 Oroville-Chico Highway, Durham. The project site is located approximately five miles southeast of Chico, westerly of Highway 99 and 1.8 miles north of the Durham-Pentz Road exit to Highway 99; Township 21N, Range 2E, Section 22; MDB&M; APN: 040-120-036.

5. Project Sponsor's Name and Address: Randy McLaughlin
8616 Durnel Drive
Durham, California 95938

6. General Plan Designation: Agriculture (AG)

7. Zoning: AG-40 (Agriculture, 40-acre minimum parcel size)

8. Description of Project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)

   The applicant is requesting a Conditional Use Permit Amendment to include unauthorized operational and site changes that have occurred since approval of Conditional Use Permit UP14-0002 and UP15-0005, and for the expansion of the facility boundary and operations.

   Existing Non-Permitted Activities

   - Approval of the as-built fire hydrant constructed outside the permitted area.
   - Unauthorized filling of isolated onsite wetlands within the project site, and the unauthorized filling of jurisdictional wetlands outside the permitted project site from an expansion of the project boundaries.
   - Unauthorized road grading activities that resulted in the filling of jurisdictional wetlands.

   Proposed Future Expansion Area

The amendment includes a proposed 64 acre expansion of the project boundary for a total site acreage of 126.7 acres, modifications to the operations at the facility, construction of new improvements, and an amendment of Condition No. 20 of Conditional Use Permit UP14-0002 to allow the receipt, chipping, and grinding of softwood logs at the facility.

Project Boundary Expansion

The current site boundary is proposed to be expanded by an additional 64 acres. The proposed expansion is primarily located north of the existing facility; however, the existing berm surrounding the facility will also be relocated closer to State Highway 99 to the east, and expanded to the south towards Hamlin Slough. The expansion will include leveling of the existing pasture and grazing lands by removing the thin layer of top soil down to the lava cap. Top soil removed from the site will be relocated to the perimeter of the expansion area to construct an earthen berm. The height of the berm will vary, depending on the amount of top soil available in the expansion area. However, the berm along State Highway 99 will be 120 feet wide, and may vary in height between 4 to 15 feet, with finished side slopes of less than 2:1. An 8-foot wide rocked cattle walk is located between the berm and the highway right-of-way. Once top soil is removed from the area, a thin layer of concrete will be distributed over the majority of the surface.

The expansion area includes two 200-ft x 200-ft (40,000 square feet) areas dedicated to finished product storage. The remaining open areas may accommodate a mixture of permitted operations including greenwaste storage, compost, and firewood.

The project also includes the use of historical rice checks to the south of the facility to filter stormwater prior to discharge, construction of a pipeline to carry stormwater to the filtration fields and maintenance, reconstruction and construction of roads to access filtration areas. The historical rice fields will be farmed in the future to improve grass health and composition to improve filtration as well as increasing grazing carrying capacity. Road grading activities also took place in this area without a County Grading Permit. This activity is now considered part of the Use Permit application's project description.

Proposed Expansion of Facility Operations

Facility operations are proposed to Increase. Storage of green waste will increase from 30,000 cubic yards to 300,000 cubic yards. Annual greenwaste processing will increase from 300,000 cubic yards per year to 500,000 cubic yards. Firewood storage and processing operations will increase from the storage of 100 cords of firewood and 6,000 cords of firewood processed each year to the storage of 5,000 cords at the site and 9,000 cords processed each year. Lastly, the volume of composting will increase up to 50 percent during the summer months.

Expansion Area Improvements

The expansion area will include several improvements to support facility operations. Improvements include: construction of internal haul roads 30 feet in width with concrete surface; construction of two 400 square foot yard offices; expansion of the onsite fire hydrant system; installation of an 80-foot truck scale; installation of one caretakers mobile home unit, installation of an onsite domestic well; installation of two additional 1,500-gallon septic systems; and installation of underground water distribution lines for the fire hydrant system and the caretaker unit.

Project Operations

The following sections discuss the operational processes that are presently occurring at the project site and processes that will be established with approval of the project. These processes include discussions of environmental monitoring and control measures that will be implemented by the applicant.

Operations Equipment

Equipment that is used at the facility includes:

- <u>Morbark 6600 Horizontal Grinder or Morbark 1300 Tub Grinder</u>

Used in the processing of biomass. The proposed facility expansion will require an additional grinder for a total of two.

- Front Wheel Loaders

  At least 2 front wheel loaders are onsite at all times. An additional two loaders will be required for the facility expansion. They are used to feed material up to and into the grinders, pushing of feedstock into piles for storage, loading of biomass fuel and compost into trailers for transport, moving and turning of compost, moving of firewood and firewood scraps, as well any other material-moving needs.

- (Added since 2014) Compost Turner

  Used for turning the compost rows to introduce oxygen and mix the material.

- Powerscreen

  Used for screening material from grinding operations to separate the fines (smaller particles such as dirt) from the higher-quality biomass fuel. It is also used for screening finished compost product to remove large pieces prior to sale.

- Truck Tipper

  Used for removing the contents of a commercial truck trailer by raising the trailer to a steep angle so that gravity causes the material to slide out the back.

- Water Truck

  Used for suppressing dust caused by vehicles and grinding operations, fire suppression, watering of compost to maintain moisture levels and lower temperatures, extracting accumulations of water for distribution elsewhere and applying additives to the composting piles.

- Forklift

  Used for unloading pallets, crates, and moving packaged firewood products for storage or transport.

- Hydraulic Wood splitters

  Used for splitting firewood rounds into pieces that can be wrapped into firewood bundles or sold as bulk firewood.

- Baker Band Saw

  Used for cutting orchard/farm logs into square logs, prior to the curing stage of the operation.

- Rip Saw

  Used for cutting cured logs into boards, prior to shipping materials offsite for additional processing.

Chipping and Grinding Operations

Old Durham Wood no longer receives municipal greenwaste from November 1 to March 31. Material used in the chipping and grinding operation comes from orchard removal and woody debris from the general public and commercial businesses. Materials received include, but are not limited to, untreated wood, natural fiber products, hardwood and softwood logs, and construction and demolition wood waste. The site does not receive food material, bio solids, mixed solid waste, materials processed from commingled collection, wood containing lead-based paint or wood preservative, municipal greenwaste, or mixed construction/demolition debris. The project includes an amendment to Condition No. 20 of UP14-0002 to allow chipping and grinding of softwood logs at the site.

The general public and commercial businesses can deliver woody debris materials to the facility. Materials are unloaded by hand or by other mechanical methods that are under their control (i.e. dumping trailers and dumping truck beds). For some commercial businesses that deliver large quantities of pallets or wooden crates, a forklift is used to aid in the unloading of the materials. Once a sufficient amount of material has accumulated, it is transported to the grinder to be processed into biomass fuel for consumption in a cogeneration power plant. The grinder is not stationary and is moved to areas where materials are located for grinding.

The chipping and grinding operation will have the capacity to store up to 300,000 cubic yards of material. Materials are processed through a horizontal grinder and then passed through a screen to separate the smaller material (fines) from the larger material. Larger chips are sent as fuel while fines are composted onsite. The larger materials, such as tree stumps and logs, are processed less frequently (i.e. when a large amount has accumulated).

The length of time that the processed materials remain onsite depends on the needs of the cogeneration power plants and orders for compost buyers. At certain times of the year cogeneration facilities stop accepting material, in which case materials will be stored onsite pending need. During the fall and winter months cogeneration power plants have a greater need for material to burn and will accept more material. During the late spring and summer more agriculture material is available. Material may stay onsite for up to two months, but is normally rotated out within four weeks. A total of 500,000 cubic yards of material will be processed each year.

Firewood Processing and Storage Operations

The firewood processing and storage operation includes the sale of orchard and farm wood obtained from offsite sources, on a site occupying approximately 10 percent of the parcel's total size and where up to 5,000 cords of firewood are stored for processing and offsite or onsite sales.

Wood used in the firewood-processing operations is generally harvested from area orchards. It consists mainly of almond, walnut, and eucalyptus, but can also include other types of orchard or farm wood. Wood is cut offsite and loaded onto trucks and hauled into the project site to be stored and cured. The wood brought to the site is unloaded in the storage area for seasoning. The wood is cured until the moisture content is below 20 percent, which generally takes 10 to 12 months. Cured wood is then split using portable hydraulic wood splitters. Split firewood is assembled into bundles, stacked on pallets, and shrink-wrapped. Firewood pallets are moved into the onsite building for storage. Up to 9,000 cords of wood will be processed every year. Commercial trucks ship the finished product to customers. Approximately 400 commercial truck trips are generated each year (800 including return trips). The majority of truck trips occur between November and January, with approximately 8 to 38 truck trips each week. Approximately 3 to 8 truck trips are generated each week during the remaining months of the year.

Composting Operations

Composting is the controlled decomposition of organic materials by microorganisms. The result of this decomposition process is compost, a crumbly, earth-smelling, soil-like material that can be applied as a soil conditioner and organic fertilizer to gardens, crops, and rangelands. Compost provides organic matter and nutrients (such as nitrogen and potassium) to the soil and improves soil texture.

Feedstock material for composting operations is generated from fines produced during chipping and grinding operations. Composting feedstock is initially pushed into static piles until a sufficient quantity of feedstock has been accumulated, at which point composting feedstock is transported by trailers or loaders into designated windrow areas. Historically, approximately 30 to 35 acres were used for composting operations. Windrows are no larger than 700 feet long by 25 feet wide by 8 feet high and are spaced at least 4 feet apart to provide access, windrow loading, monitoring, watering, and turning. Composting has been curtailed during the winter season (November 30 to April 1) to achieve compliance with the RWQCB General Order for Composting Activities.

The temperature and moisture of the composting materials are monitored and controlled on a weekly basis. New feedstock materials are subsequently added to the newest side of the windrow. Windrows are turned a minimum of five times during the 15-day pathogen-reduction period to promote aerobic decomposition.

When the desired level of decomposition has been achieved, the compost materials are moved into curing piles for several weeks to months. Upon completion of the curing stage, the finished compost is screened and transported for offsite sale. Any compost remaining onsite as of November 30 is covered.

Orchard/Farm Wood Processing Operations (Milling)

Wood used for offsite wood veneer production is obtained from area orchard supplies and brought to the site intermittently. Wood is initially cut offsite and then transported to the site by trucks. Once onsite, chainsaws are used to trim the logs into appropriate sizes and then milled into square logs to be stacked on pallets to dry. When logs reach the appropriate moisture content, logs are cut into dimensional lumber with the rip saw and transported offsite for additional processing. All scraps generated from processing operations become feedstock material for chipping and grinding operations. Some milling may occur onsite.

Onsite Personnel

Total personnel onsite are proposed to be approximately 25 to 46 employees.

Chipping and grinding operations will consist of 6 to 12 employees. Employees are always onsite during business hours that are engaged in the grinding and moving of material, moving of equipment around the yard, loading and unloading of commercial trucks, and performing repairs and maintenance. An additional employee is onsite to operate the water truck, when needed.

Composting operations consist of 4 to 8 part-time employees. Sometimes this consists of the operators from the chipping and grinding operations. Their jobs consist of taking temperature readings, watering the piles, turning the piles, applying additives and amendments, moving of compostable materials from static piles into windrows, and loading of the finished product to be shipped offsite.

Firewood operations consist of 9 to 18 employees. They work in and around the piles of wood that are curing throughout the yard. They also work in and around the storage building when receiving materials or loading trucks. Between 4 and 8 of the employees use hydraulic wood splitters to split the round logs into smaller pieces. Between 5 and 10 people then take the smaller pieces, wrap them into small bundles of firewood, and place them on pallets for shipment.

Orchard/farm wood processing consists of 6 to 8 employees. The employees will perform multiple functions including materials handling, using chainsaws to trim logs, loading and unloading trucks, and maintaining equipment.

Caretaker Unit

One modular residence for a night watchman. Unit is located adjacent to the yard office.

Water

Water is used for domestic uses, applied to compost piles to maintain the appropriate composting moisture content, and applied to travel ways to suppress fugitive dust emissions. Water is currently provided by an onsite well. An additional groundwater well is proposed to provide water to the expansion area. Water is transferred by underground water lines to fire hydrants in areas identified on the Site Plan (see Figure 2). Additional water for composting may also be pumped from the stormwater retention pond.

Stormwater Runoff

Stormwater which contacts compost must be retained onsite. Therefore, Old Durham Wood has ceased composting in winter months. Coverage under the General Permit for Stormwater Discharges Associated with Industrial Activities (Order 2014-0057-DWQ) has been obtained for other site discharges. A pipeline has been constructed that transports water under Hamlin Slough for biological filtration using old rice checks located south of the facility. The checks filter site stormwater prior to discharge to Hamlin Slough.

The work will also include maintenance and improvement to the existing farm service roads that runs along the pipeline alignment on the southern parcel. This existing road, which parallels the stormwater pipeline (shown on Figure 2) has historically provided access for farming, rice check maintenance, and power line easement maintenance. Road grading activities also took place in this area without a County Grading Permit. This activity is now considered part of the Use Permit application's project description. ODW upgraded the existing site road and obtained an encroachment permit for the new access location. Additional road work to maintain and construct additional access roads around the filtration fields adjacent to the existing discharge field is anticipated. The pipeline will also be expanded to allow the use of the entire rice check area for filtration.

Septic System

The project includes three onsite 1,500-gallon tanks used in one septic system for wastewater disposal needs. The septic system/dispersal bed replacement field is located on the southwest corner of the project site. An additional two 1,500-gallon septic systems will be installed at the proposed additional yard offices/caretaker units.

Environmental Monitoring and Controls

A description of the proposed methods used to monitor and control leachate, litter, odors, dust, rodents, and insects as described as follows:

<u>Odor</u>

The facility has prepared and maintains an Odor Impact Minimization Plan pursuant to 14 CCR § 17863.4. In general, the Plan requires the following steps in the event of odors noticed at the site:

- Investigate and determine the likely cause offsite odor;
- Determine if onsite management practices (e.g. mixing odiferous materials with sawdust or other bulking agent, turning the windrow more frequently, remove odiferous materials from the site, etc.) could remedy any odor problems and immediately take steps to remedy the situation;
- Determine whether or not the odor has moved offsite and if so, if it is significant enough to warrant contacting the adjacent property owners and/or the LEA; and
- Record the event for further operational review.

<u>Dust</u>

Efforts are made to suppress fugitive dust particulates during high wind conditions by applying water from a water truck or water trailer. Fire hydrants are located around the facility that can be used to spray water on materials or along roadways to suppress dust emissions.

<u>Leachate</u>

Under normal circumstances, moisture content does not exceed the field capacity of the compost material and no leachate is produced during the summer.

<u>Rodents</u>

Materials onsite are not generally considered a food sources for rodents. Any rodents present at the site are mostly kept under control by area wildlife (i.e. hawks, owls). If rodents become an issue, traps will be distributed at the site.

<u>Insects</u>

Insect activity is monitored at the site. A contract pest control company will be hired for insect control if it is determined to be necessary.

<u>Litter</u>

Limited sources that generate litter are found in feedstocks. The facility rejects and returns to the generator any load that contains excessive litter. Covered trash containers are provided in areas where employees and visitors generate litter. Onsite litter is collected routinely and disposed of properly.

Hours of Operation

The facility operates Monday through Saturday, with the facility closing on Christmas Day and New Year's Day. Hours of operations occur between 7:00 a.m. and 7:00 p.m., with the site open to the public between 7:00 a.m. and 4:00 p.m.

Hazardous Materials

Hazardous materials that are currently onsite, and proposed to be added to the facility, consist of the following:

Diesel Fuel

Diesel fuel is currently stored in a 500-gallon trap wagon to fuel equipment used at the facility. Eventually, a 10,000-gallon tank will be used for red diesel and a 10,000-gallon tank for on-road diesel.

Gasoline

Gasoline that is used for the wood splitter engines is currently stored in a 500-gallon aboveground tank located near the existing metal building. The proposed expansion includes installation of a 1,000-gallon aboveground tank.

Hydraulic Oil

Hydraulic oil used in the wood splitters is currently kept in 5-gallon buckets inside the metal building.

Engine Oil

Used engine oil is currently kept in 5-gallon buckets inside the metal building prior to being transported to the owner's property at 8616 Durnel Drive to be added to the waste oil container. New engine oil is stored in 5-gallon buckets that are kept inside the metal building, which is used for the wood splitters.

9. Surrounding Land Uses and Setting: (Briefly describe the project's surroundings)

Surrounding land uses are comprised of large grazing land and orchards, which include agricultural-related structures and single-family residences. The parcel sizes in the surrounding area range in size from 2.8 acres to 235 acres. Public right-of-ways in the vicinity of the project site include Oroville-Chico Highway, a County-maintained roadway, to the south, and State Route 99 to the north. Access to the subject property is limited to Oroville-Chico Highway. The nearest residences are located approximately 425 feet (898 Oroville-Chico Hwy), 1,100 feet (1195 Oroville-Chico Hwy), 1,350 feet (1269 Mesa Road), and 1,975 feet (1251 Oroville-Chico Hwy). The residence located at 898 Oroville-Chico Hwy is located south of the stormwater discharge field.

Direction	General Plan Designation	Zoning	Existing Land Use(s)
North	Agriculture	AG-40	Agriculture (Grazing)
South	Agriculture	AG-20	Agriculture (Orchards & Grazing)
East	Agriculture	AG-40	Agriculture (Grazing)
West	Agriculture	AG-40	Agriculture (Orchards & Grazing)

Old Durham Wood facility is located in the unincorporated area of Butte County, situated between Oroville-Chico Highway to the southwest and State Highway 99 to the northeast, located approximately 5 miles southeast of the City of Chico (Figure 1). The facility's address is 974 Oroville-Chico Highway, Durham, California. It is located at Latitude 39.655451 N, Longitude -121.743761 W; and Township 21N, Range 2E, Section 22; MDB&M. The Assessor's Parcel Number is 040-120-036. The elevation of the project site ranges between

172 to 226 feet above mean sea level (msl). The topography of the project site is level with 3 percent to 4 percent slopes falling from the north to the south towards Oroville-Chico Highway.

Existing Entitlements

Old Durham Wood, Inc., has operated since 2014 under Conditional Use Permit UP14-0002 (approved on May 22, 2014) and Conditional Use Permit UP15-0005 (approved on February 25, 2016). Conditional Use Permit UP14-0002 was approved to recognize an unpermitted 33-acre greenwaste receiving, chipping and grinding operation, composting facility, and firewood processing operation, bringing the facility into compliance with Butte County Zoning Code. The use permit also permitted a +/- 25 acre expansion of the facility, as well as established an orchard/farm wood milling operation to produce boards for off-site wood veneer production. An amendment to UP14-0002 was approved by the County (UP15-0005) on February 25, 2016. The amendment allowed for the installation of a security employee unit; temporary use of a recreational vehicle as a residence during construction of the proposed expansion; and, relocation of the hazardous materials depot permitted under UP14-0002. However, UP15-0005 expired after two years without the proposed security unit having been installed, and the recreational vehicle was ultimately removed.

An Initial Study/Mitigated Negative Declaration (SCH# 2014042060) was prepared and approved for Conditional Use Permit UP14-0002. An Addendum to the IS/MND was approved for Conditional Use Permit UP15-0005. The IS/MND contained thirteen mitigation measures to reduce identified significant impacts to a less than significant level. The full scope of permitted operations, potential environmental impacts, and recommended mitigation measures are included as an attachment.

UP14-0002	
Permitted Area	58 acres
Compost Operations	6.64 acres
Green Waste Receiving	300,000 cubic yards/year
Green Waste Storage	2.93 acres / max. 30,000 cubic yards
Firewood Processing	6,000 cords/year
Firewood Storage	Less than 20% of project area (58 acres). Maximum 100 cords
Employees	19 - 28
Veneer Board Processing	Limited to orchard wood trimming, milling and curing.
Hazardous Materials	(2) 10,000 gallon tanks - Diesel Fuel 1,000 gallons - Gasoline 350 gallons - Hydraulic Oil 350 gallons - Engine Oil
Future Construction	30,000 square foot warehouse (3) 2,400 square foot pole barns (storage of woodworking equipment and wood veneers) (8) 450 square foot solar kilns (Orchard/Farm wood Drying) 2,400 square foot fuel station/hazardous materials storage area

Temporary Log Storage and Processing Yard

On April 10, 2020, an Administrative Permit (ADM20-0050) was approved to temporarily utilize 40 acres of the facility for the storage of logs and processing of woody debris associated with Camp Fire Disaster Recovery Operations and Urgency Ordinance. The permit currently allows operations until December 31, 2021, unless the date is extended by the County Board of Supervisors.

Unpermitted Facility Expansion

On June 23, 2017, County staff performed a site review of the facility where it was revealed that the applicant had expanded the boundaries of the facility beyond the area authorized under Conditional Use Permit UP14-0002. The expansion was made by encroaching (grading and paving) into the 150-foot x 1,100 foot wetland buffer area (approx. 3.75 acres) located between the Phase 1 and 2 areas shown on the approved site plan. An unpermitted expansion of the project boundaries on the northeast side of the facility resulted in the unauthorized filling of jurisdictional wetlands. Disturbed wetland areas were mitigated by the applicant in 2019 through the purchase of 0.4 acres of vernal pool preservation credits at the Meridian Ranch Mitigation Bank.

This Initial Study addresses changes made to the facility and project operations which were not included in Conditional Use Permit UP14-0002 or UP15-0005 as well as an expansion of the facility. Road grading activities also took place south of the site in the vicinity of the rice checks without a County Grading Permit. This activity is now considered part of the Use Permit application's project description.

Approximately 64 acres of the 287.34-acre property are currently utilized for existing operations and support structures for the Old Durham Wood facility. Remaining acreage is used for livestock grazing and filtration of stormwater from the facility. Areas outside the existing and future expansion project areas will continue to be used for livestock grazing.

Site Improvements

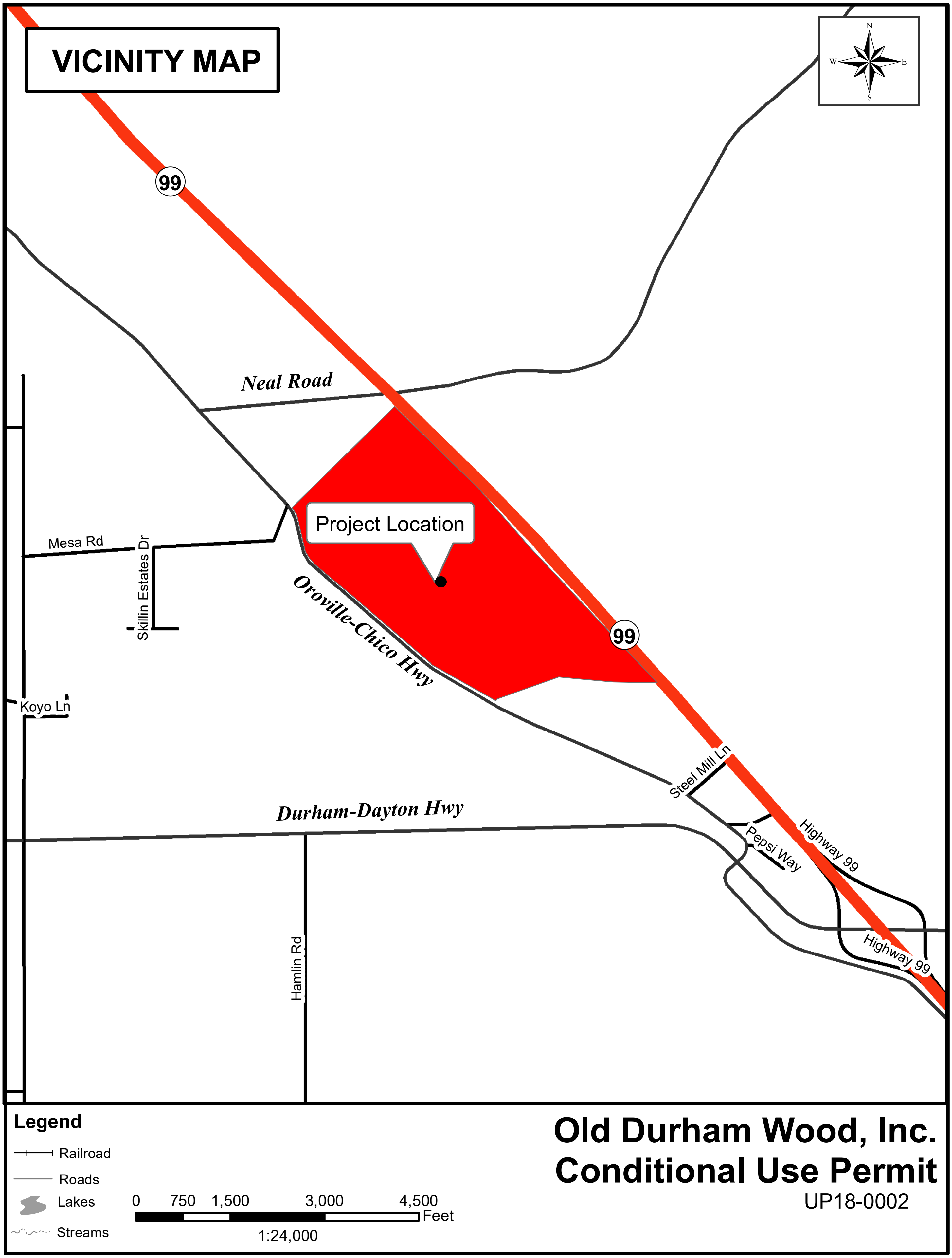
Approximately 64 acres of the 287.34-acre project site is currently developed. Existing improvements include a 12,000-square-foot metal warehouse (60 feet x 200 feet), presently used for storage of processed firewood and storage of materials associated with site operations; a 2,400 square foot office building; an onsite domestic groundwater well; two water storage tanks; and an onsite 1,500-gallon septic system for wastewater disposal needs. The system/dispersal bed replacement field is located on the southwest corner of the project site.

Oroville-Chico Highway, a county-maintained road, provides access to the project site. Driveway improvements were completed in 2015 including a 24-foot-wide travelway with asphalt approach apron and gated entrance. Internal roads run throughout the site; roads vary in width and have a native surface consisting of a durable, hardpan material with an overlay of concrete.

10. Other public agencies whose approval is required: (e.g., permits, financing approval, or participation agreement)

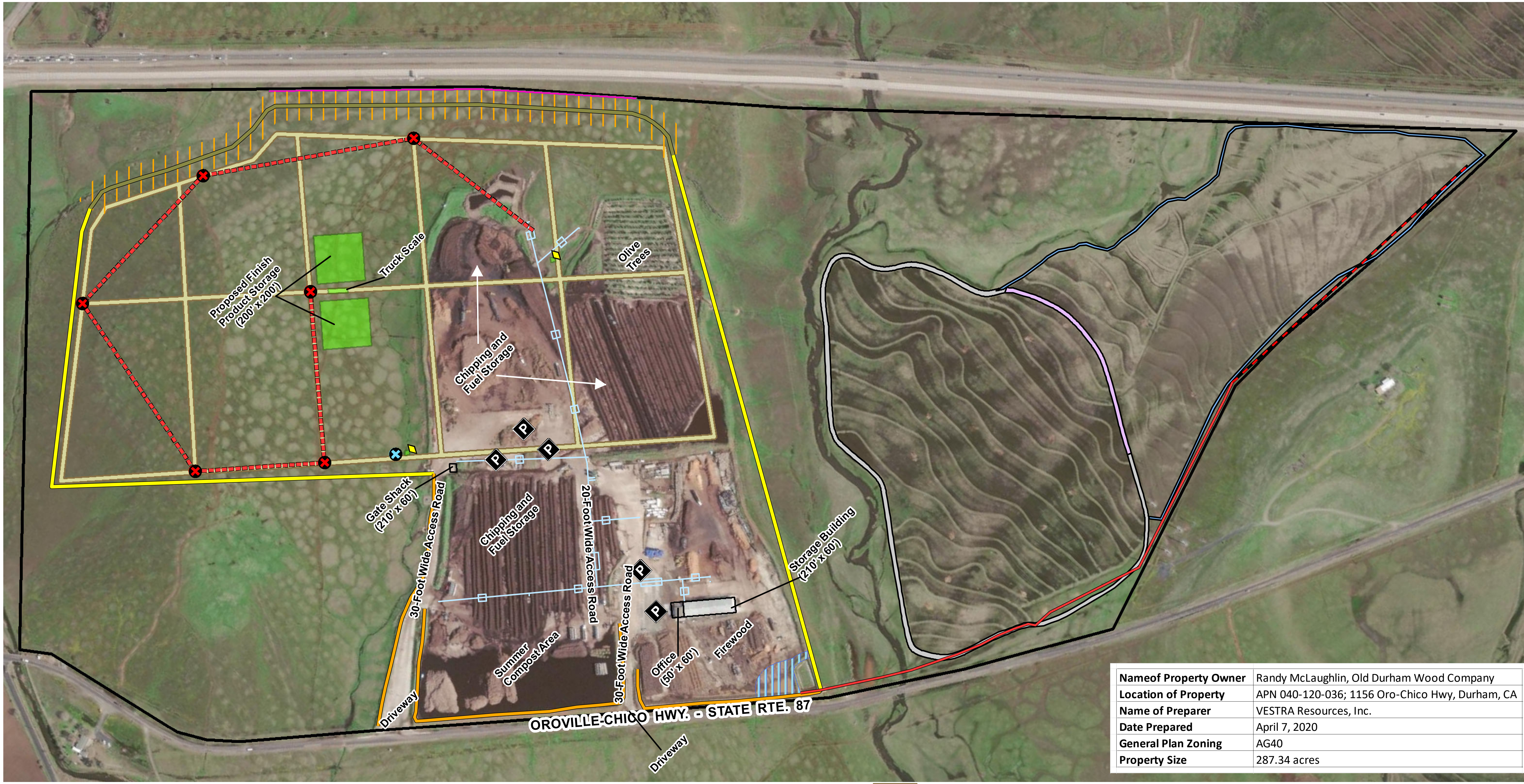
- Butte County Department Development Services: Building Permits (Fire Hydrant System)
- Butte County Environmental Health Department: Onsite Well; Wastewater Disposal Permits; revised Solid Waste Facility Permit
- Butte County Public Works Department: Encroachment Permit and Grading and Storm Drainage Plans
- An NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activity (Order 2009-0009-DWQ). The General Permit requires the preparation and implementation of a SWPPP, which must be prepared before construction begins.
- An Air Quality Permit issued by the Butte County Air Quality Management District.
- A revised NPDES General Permit for Stormwater Discharges Associated with Industrial Activities (Order NPDES NO. CAS000001/2014-0057-DWQ).
- CWA Act Permit from Regional Water Quality Control Board/Army Corps for Impacts to Waters of the U.S./Waters of the State.
- A revised Technical Report under Regional Water Quality Control Board (RWQCB) General Waste Discharge Requirements for Composting Operations (Order WQ 2015-0121-DWQ).

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, is there a plan for consultation that



Old Durham Wood, Inc.
Conditional Use Permit

UP18-0002



Nameof Property Owner	Randy McLaughlin, Old Durham Wood Company
Location of Property	APN 040-120-036; 1156 Oro-Chico Hwy, Durham, CA
Name of Preparer	VESTRA Resources, Inc.
Date Prepared	April 7, 2020
General Plan Zoning	AG40
Property Size	287.34 acres

Proposed Septic
Proposed Fire Hydrant
Proposed Well
Parking
Stormwater Pipeline
Proposed Expansion of Stormwater Pipeline
Berm
Proposed Outside Border Berm
Proposed Outside Grazing Berm
Proposed Fire Water System Pipes
Fire System Water Pipes
Proposed Road
New Road
Reconstructed Road
Proposed Building
Proposed Access Road
Detention Pond
Rocked Access Corridor
Buildings
Approximate Parcel Boundary

N

0 200 400 800 Feet
1 inch = 400 feet

VESTRA

SOURCE: DIGITALGLOBE 2018 AERIAL PHOTOGRAPH

FIGURE 1
PROPOSED SITE PLAN
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

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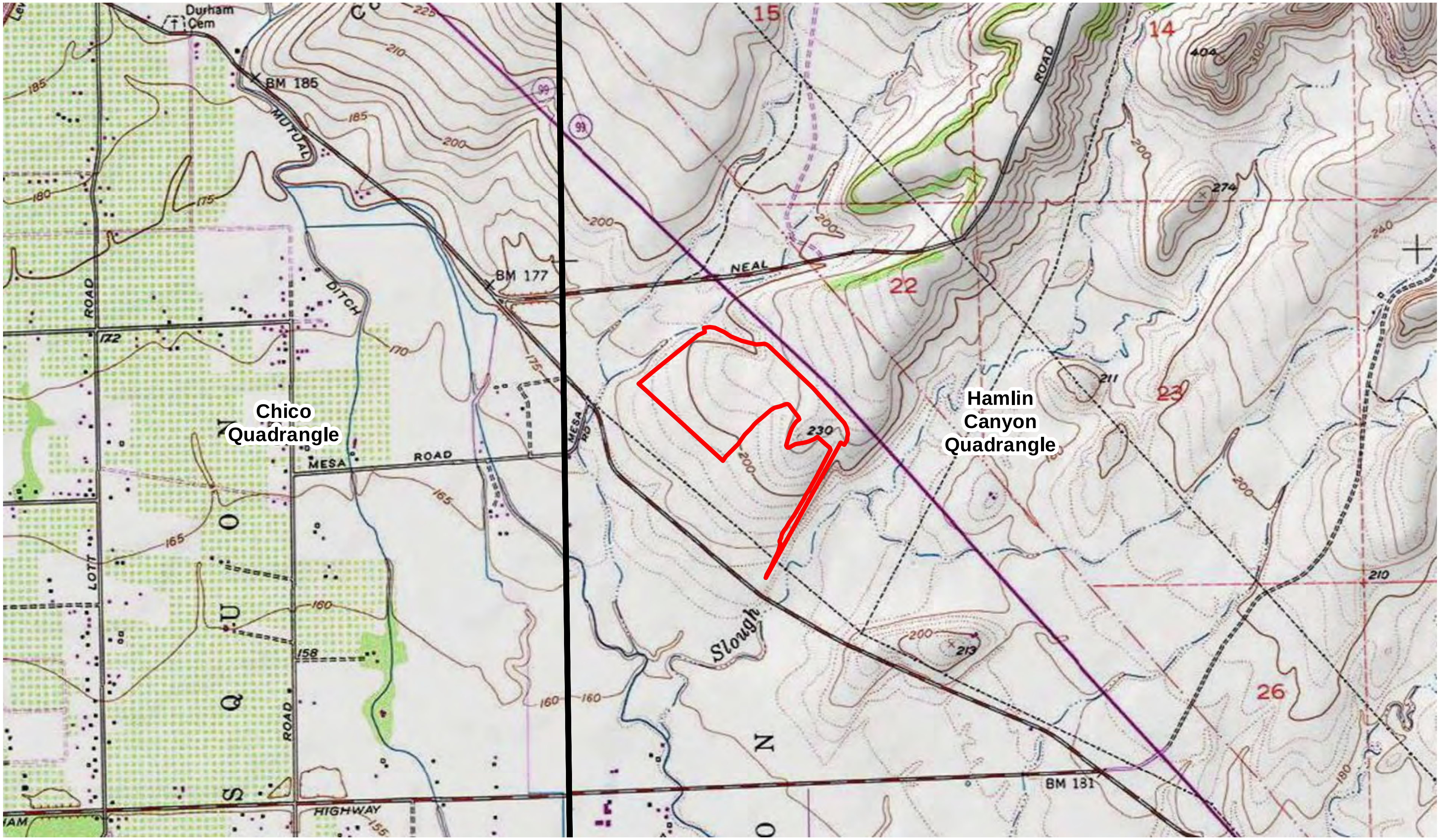

Proposed Expansion Boundary (63.9 acres)

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

VESTRA

SOURCE: USGS 7.5' TOPOGRAPHIC MAP, HAMLIN CANYON QUADRANGLE

FIGURE 1
SITE LOCATION
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

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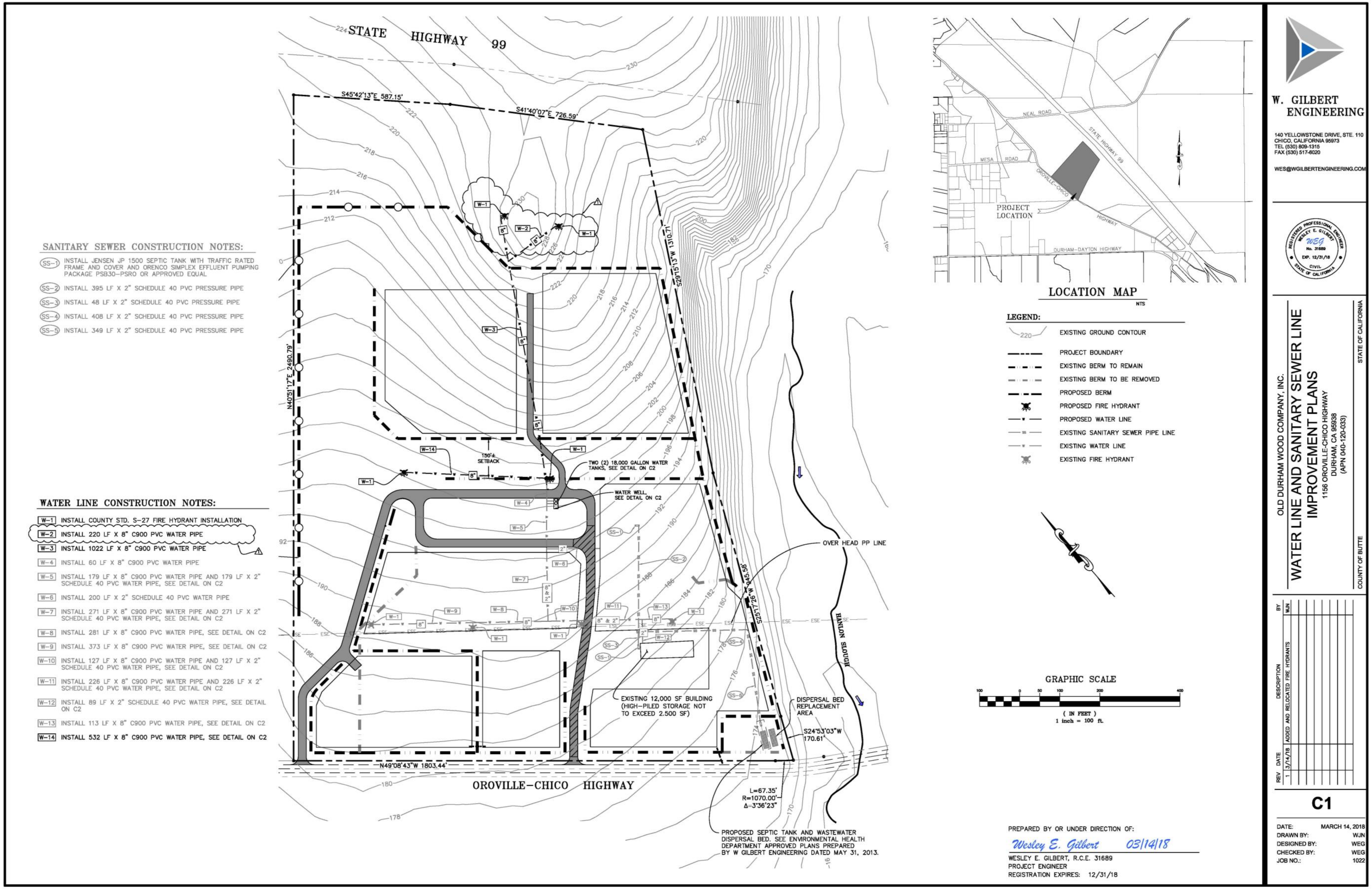

VESTRA

SOURCE: OLD DURHAM WOOD, INC. 2015 INITIAL STUDY

FIGURE 2
SITE PLAN
OLD DURHAM WOOD, INC.
DURHAM, CA

P:\Projects\2017\71730 Old Durham Wood\2018 Initial Study\Figures and Appendices

FIGURE 3
2013 WETLAND DELINEATION
OLD DURHAM WOOD, INC.
DURHAM, CA

VESTRA

SOURCE: GALLAWAY ENTERPRISES DRAFT WETLAND DELINEATION

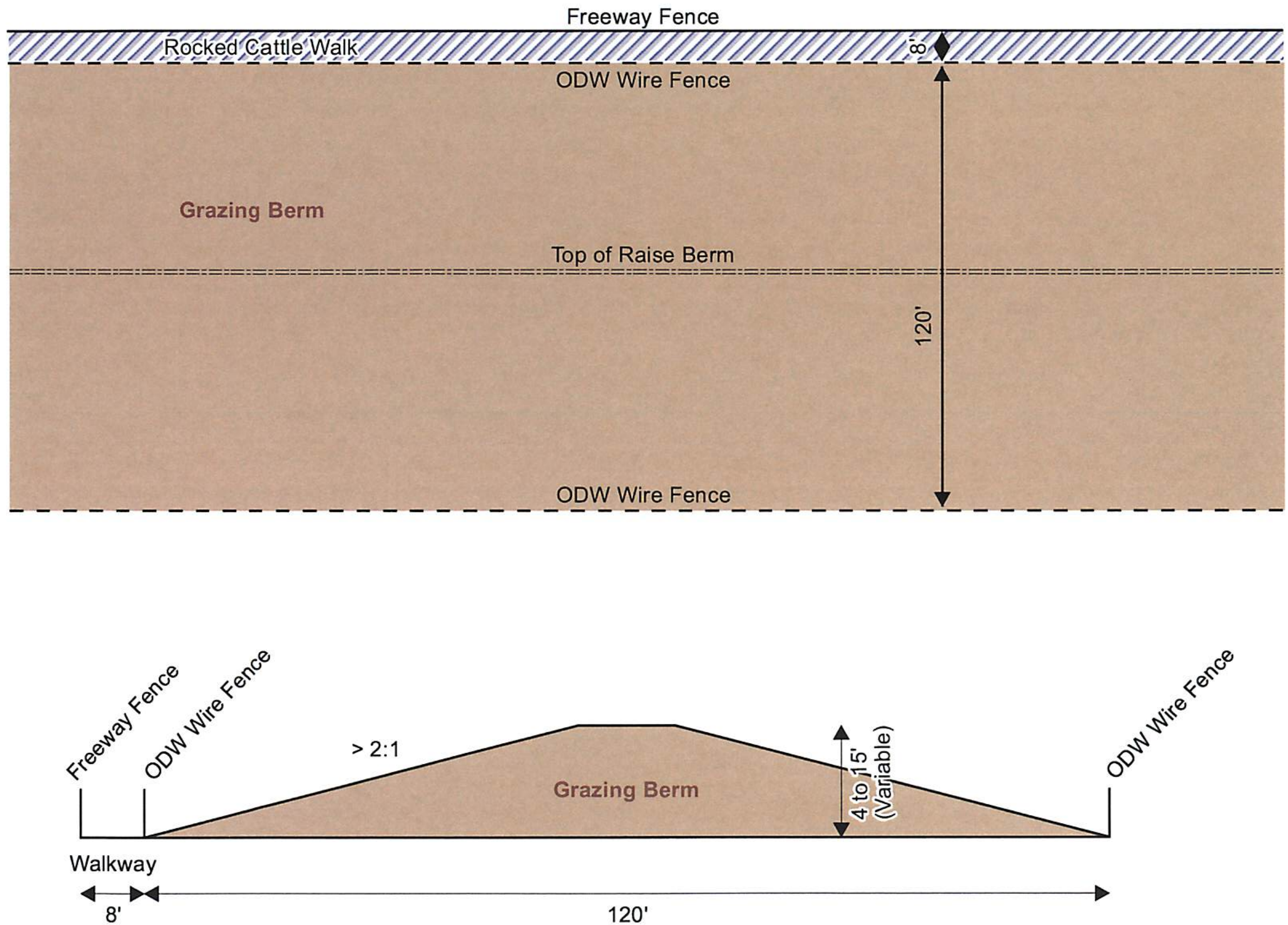

FIGURE 1
GRAZING BERM DETAIL
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

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See Discussion under Section 1.18.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages. Where checked below, the topic with a potentially significant impact will be addressed in an environmental impact report.

☐	Aesthetics	☐	Agriculture and Forest Resources	☐	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Energy
☐	Geology / Soils	☐	Greenhouse Gas Emissions	☐	Hazards / Hazardous Materials
☐	Hydrology / Water Quality	☐	Land Use / Planning	☐	Mineral Resources
☐	Noise	☐	Population / Housing	☐	Public Services
☐	Recreation	☐	Transportation	☐	Tribal Cultural Resources
☐	Utilities / Service Systems	☐	Wildfire	☐	Mandatory Findings of Significance
		☐	None	☒	None with Mitigation Incorporated

DETERMINATION (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☐ I find that the proposed project could not have a significant effect on the environment, and a **NEGATIVE DECLARATION** will be prepared.

☒ I find that although the proposed project COULD have a significant effect on the environment, there WILL NOT be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A **MITIGATED NEGATIVE DECLARATION** will be prepared.

☐ I find that the proposed project **MAY** have a significant effect on the environment, and an **ENVIRONMENTAL IMPACT REPORT** is required.

☐ I find that the proposed project **MAY** have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An **ENVIRONMENTAL IMPACT REPORT** is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier **EIR** or **NEGATIVE DECLARATION** pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier **EIR** or **NEGATIVE DECLARATION**, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Rowland Hickel　　　　1/5/2021

Prepared by Rowland Hickel, Senior Planner　　　　Date

Dan Breedon　　　　January 5, 2021

Reviewed by: Dan Breedon, Planning Manager　　　　Date

EVALUATION OF ENVIRONMENTAL IMPACTS

1. A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).
2. All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.
3. Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.
4. "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from "Earlier Analyses," as described in (5) below, may be cross-referenced).
5. Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:
   a) Earlier Analysis Used. Identify and state where they are available for review.
   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.
   c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.
6. Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.
7. Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.
8. This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.
9. The explanation of each issue should identify:
   a) the significance criteria or threshold, if any, used to evaluate each question; and
   b) the mitigation measure identified, if any, to reduce the impact to less than significance.

1.1 AESTHETICS

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. Aesthetics.				
Except as provided in Public Resources Code section 21099 (where aesthetic impacts shall not be considered significant for qualifying residential, mixed-use residential, and employment centers), would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☒	☐
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage points.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☒	☐	☐

Setting

The project area is characterized as open pasture and agricultural lands situated in the rural valley region of Butte County, approximately 3 miles east from the unincorporated farming community of Durham, approximately 5 miles south from the City of Chico, and directly southwest from State Route 99. The topography of the project area is gentle and flat, with elevations ranging from 60 to 200 feet above sea level. The level topography of the valley region contributes to an open and uniform visual character, with natural waterways and canals, and associated levees, providing the most dominate landscape features. Natural vegetation in the area consists of valley grasslands and vernal pools. The most prominent human-made features are the scattered rural residences, farm structures, roads, utility line. Many other small farming and ranching towns exist within the valley floor, and typically include a small town center surrounded by suburban and rural residential development. From the open valley area, the most prominent scenic views are to distant features such as the Sutter Buttes to the south, the Coast Ranges to the west, and the county's eastern foothills, including Table Mountain.

Approximately 60 acres of the 287.34-acre property are currently utilized for existing operations and support structures for the Old Durham Wood facility.

Discussion

a) Have a substantial adverse effect on a scenic vista?

Less than significant impact. The project will expand the boundaries of the facility and includes additional structures. The location of the project within the valley makes it visible from various vantage points from around the valley and foothill regions of the county, which could adversely affect scenic vistas. Nearby uses include the Neal Road Landfill. The project is situated in an area that does not have scenic resources that the project would detract from, including water features, unique geologic features and wildlife habitat areas. Additionally, the project site is located on the valley floor, limiting the visual impacts from adjacent areas.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

Less than significant impact. The expansion of the project area will relocate the eastern boundary of project operations within closer proximity to State Route Highway 99 and further to the northwest. A berm is installed along the current boundary of the facility which serves to prevent visibility from offsite. The additional proposed expansion area to the north will also include a berm along the boundary to prevent visibility from offsite. State Route 99 is not designated as a scenic highway by any local, State or Federal agency, including the County. As a result, implementation of the project would have no impact on scenic resources along a scenic highway.

c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage points.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?

Less than significant impact. The project is located in a non-urbanized area. The developed portion of the project site currently includes features such as large storage buildings, heavy equipment operations, stockpiled materials, and accessory structures and uses. The project will increase the operational area of the facility and includes new structures. These features may be typically found on other large-scale agricultural operations, located on agriculturally-zoned lands found in the valley region of the county. Although there would be changes to the project site and expansion of the facility with approval of the proposed project, the overall character and visual integrity of the site would be consistent with the rural character and quality of the surrounding area. In addition, berms surrounding the facility will reduce visibility of the site.

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

Less than significant impact with mitigation incorporated. Implementation of the project does not significantly increase light within the project site, or the amount of light that would spill over to adjacent land uses, due to project operations occurring during daytime hours. If lighting would be used at the site, it would typically be located within the structures located at the site. Some outdoor lighting may be necessary during nighttime hours to ensure worker safety or security for the facility. Any outdoor lighting used at the site would be consistent with standards in Article 14, General Regulations, Division 4 – Outdoor Lighting, as specified in the Butte County Zoning Code, which requires that all outdoor lighting be adequately shielded and directed such that no direct light falls outside the property perimeter, or into the public right-of-way.

To provide further protection for residential uses in the project area from on-site lighting, implementation of **Mitigation Measure AES-1** is recommended. With implementation of applicable outdoor lighting regulations provided in Article 14 and **Mitigation Measure AES-1**, the proposed project would not create new sources of substantial lighting or glare that would generate a significant impact. Impacts would be less than significant under this threshold.

Mitigation Measures

<u>Mitigation Measure AES-1</u>:

All *lighting*, exterior and interior, shall be designed and located so as to confine direct *lighting* to the premises. A light source shall not shine upon or illuminate directly on any surface other than the area required to be lighted. No *lighting* shall be of the type or in a location such that it constitutes a hazard to vehicular traffic, either on private property or the abutting highway or street.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. The Development Services Department shall investigate and respond to any complaints of excess glare or light originating from the project site.

1.2 AGRICULTURE AND FOREST RESOURCES

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
II. Agriculture and Forest Resources.				
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997, as updated) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland.				
In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board.				
Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☒	☐

Environmental Setting

The project site is located on agricultural grazing lands and is situated in the AG-40 (Agricultural, 40-acre minimum parcel size) zone district. The Land Use Element Map of the Butte County General Plan designates the project site as Agriculture (AG). The agriculture land use designation is primarily for the cultivation, harvest, storage, processing, sale and distribution of all plant crops, especially annual food crops, as well as roadside stands for the sale of agricultural products grown or processed on the property. Secondary uses consistent with this designation include animal husbandry, composting facilities, firewood processing, and residential uses. Additional allowable uses and conditionally allowed uses for agriculture zoned lands are specified under Section 24-13 of the Butte County Zoning Ordinance.

Farmland Mapping

To characterize the environmental baseline for agricultural resources, Important Farmland Maps produced by the California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP) were reviewed. Important Farmland maps show categories of Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Farmland of Local Importance (if adopted by the county), Grazing Land, Urban and Built-up Land, Other Land, and Water. Prime Farmland and Farmland of Statewide Importance map categories are based on qualifying soil types, as determined by the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), as well as current land use. These map categories are defined by the Department of Conservation's FMMP as follows:

> **Prime Farmland:** Land which has the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed, including water management, according to current farming methods.
>
> **Farmland of Statewide Importance:** Land that is similar to *Prime Farmland* but with minor shortcomings, such as greater slopes or less ability to hold and store moisture.
>
> **Unique Farmland:** Land of lesser quality soils used for the production of specific high economic value crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality or high yields of a specific crop when treated and managed according to current farming methods. It is usually irrigated, but may include non-irrigated orchards or vineyards as found in some climatic zones in California. Examples of crops include oranges, olives, avocados, rice, grapes, and cut flowers.
>
> **Farmland of Local Importance:** Land of importance to the local agricultural economy, as determined by each county's board of supervisors and local advisory committees. Examples include dairies, dryland farming, aquaculture, and uncultivated areas with soils qualifying for *Prime Farmland* and *Farmland of Statewide Importance*. Butte County has not adopted a definition of Farmland of Local Importance.
>
> **Grazing Land:** Land on which existing vegetation, whether grown naturally or through management, is suitable for grazing or browsing of livestock.
>
> **Urban and Built-up Land:** Land used for residential, industrial, commercial, construction, institutional, public administrative purpose, railroad yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water control structures, and other development purposes. Highways, railroads, and other transportation facilities are also included in this category.
>
> **Water:** Water areas with an extent of at least 40 acres.

The project site is identified by the Department of Conservation as containing lands classified as *Grazing Land* and *Other Land*. The majority of the parcel is designated as *Grazing Land*.

Williamson Act

The California Land Conservation Act of 1965, commonly known as the Williamson Act, was established based on numerous State legislative findings regarding the importance of agricultural lands in an urbanizing society. Policies emanating from those findings include those that discourage premature and unnecessary conversion of agricultural land to urban uses and discourage discontinuous urban development patterns, which unnecessarily increase the costs of community services to community residents. The Williamson Act authorizes each County to establish an agricultural preserve. Land that is within the agricultural preserve is eligible to be placed under a contract between the property owner and County that would restrict the use of the land to agriculture in exchange for a tax assessment that is based on the yearly production yield. The contracts have a 10-year term that is automatically renewed each year, unless the property owner or county requests a non-renewal or the contract is cancelled. The project site is not encumbered by a Williamson Act contract. Additionally, no properties are the immediate vicinity of the project site that is under a Williamson Act contract.

Discussion

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

No impact. The project site is not designated as Important Farmland in the Farmland Mapping and Monitoring Program. Therefore, the project will not result in the conversion of Important Farmland to a non-agricultural use.

b) Conflict with existing zoning for agricultural use or a Williamson Act contract?

No impact. The project site is zoned for agricultural uses, but is not restricted by a Williamson Act contract. Additionally, the project operations are an allowed use within the agriculture zone, with the issuance of a Conditional Use Permit, and are intended to support, protect, and maintain the long-term agricultural viability within the county by minimizing land-use conflicts.

c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?

No impact. The project site and surrounding area is not classified as forestland, as defined in Public Resources Code Section 12220(g), or as timberland, as defined in Public Resources Code Section 4526. The project site is not zoned or designated for forest or timber resource uses.

d) Result in the loss of forest land or conversion of forest land to non-forest use?

No impact. The project site contains native and non-native grassland vegetation but is does not contain trees or timber resources classified as forestland, as defined in Public Resources Code Section 12220(g), or as timberland, as defined in Public Resources Code Section 4526. Therefore, the proposed project would not result in the loss or conversion of forest land to a non-forest use.

e) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or conversion of forest land to non-forest use?

Less than significant impact. The project is a conditionally allowable use in the agriculture zone and does not create any potential land-use conflicts with surrounding agricultural uses that could lead to the premature conversion of agricultural resources. The chipping and grinding and orchard and farm wood processing provided by this facility is an important asset to the area's agricultural economy.

1.3 AIR QUALITY

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
III. Air Quality.				
Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied on to make the following determinations.				
Are significance criteria established by the applicable air district available to rely on for significance determinations?	☒ Yes		☐ No	
Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?	☐	☒	☐	☐
c) Expose sensitive receptors to substantial pollutant concentrations?	☐	☒	☐	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☐	☒	☐	☐

Environmental Setting

Butte County is located within the Sacramento Valley Air Basin (SVAB), comprising the northern half of California's 400-mile long Great Central Valley. The SVAB encompasses approximately 14,994 square miles with a largely flat valley floor (excepting the Sutter Buttes) about 200 miles long and up to 150 miles wide, bordered on its east, north and west by the Sierra Nevada, Cascade and Coast mountain ranges, respectively.

The SVAB, containing 11 counties and some two million people, is divided into two air quality planning areas based on the amount of pollutant transport from one area to the other and the level of emissions within each. Butte County is within the Northern Sacramento Valley Air Basin (NSVAB), which is composed of Butte, Colusa, Glenn, Shasta, Sutter, Tehama, and Yuba Counties.

Emissions from the urbanized portion of the basin (Sacramento, Yolo, Solano, and Placer Counties) dominate the emission inventory for the Sacramento Valley Air Basin, and on-road motor vehicles are the primary source of emissions in the Sacramento metropolitan area. While pollutant concentrations have generally declined over the years, additional emission reductions will be needed to attain the State and national ambient air quality standards in the SVAB.

Seasonal weather patterns have a significant effect on regional and local air quality. The Sacramento Valley and Butte County have a Mediterranean climate, characterized by hot, dry summers and cool, wet winters. Winter weather is governed by cyclonic storms from the North Pacific, while summer weather is typically subject to a high pressure cell that deflects storms from the region.

In Butte County, winters are generally mild with daytime average temperatures in the low 50s°F and nighttime temperatures in the upper 30s°F. Temperatures range from an average January low of approximately 36°F to an average July high of approximately 96°F, although periodic lower and higher temperatures are common. Rainfall between

October and May averages about 26 inches but varies considerably year to year. Heavy snowfall often occurs in the northeastern mountainous portion of the County. Periodic rainstorms contrast with occasional stagnant weather and thick ground or "tule" fog in the moister, flatter parts of the valley. Winter winds generally come from the south, although north winds also occur.

Diminished air quality within Butte County largely results from local air pollution sources, transport of pollutants into the area from the south, the NSVAB topography, prevailing wind patterns, and certain inversion conditions that differ with the season. During the summer, sinking air forms a "lid" over the region, confining pollution within a shallow layer near the ground that leads to photochemical smog and visibility problems. During winter nights, air near the ground cools while the air above remains relatively warm, resulting in little air movement and localized pollution "hot spots" near emission sources. Carbon monoxide, nitrogen oxides, particulate matters and lead particulate concentrations tend to elevate during winter inversion conditions when little air movement may persist for weeks.

As a result, high levels of particulate matter (primarily fine particulates or PM2.5) and ground-level ozone are the pollutants of most concern to the NSVAB Districts. Ground-level ozone, the principal component of smog, forms when reactive organic gases (ROG) and nitrogen oxides (NOx) – together known as ozone precursor pollutants – react in strong sunlight. Ozone levels tend to be highest in Butte County during late spring through early fall, when sunlight is strong and constant, and emissions of the precursor pollutants are highest (Butte County CEQA Air Quality Handbook 2014).

Air Quality Attainment Status

Local monitoring data from the BCAQMD is used to designate areas a nonattainment, maintenance, attainment, or unclassified for the National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS). The four designations are further defined as follows:

Nonattainment – assigned to areas where monitored pollutant concentrations consistently violate the standard in question.

Maintenance – assigned to areas where monitored pollutant concentrations exceeded the standard in question in the past but are no longer in violation of that standard.

Attainment – assigned to areas where pollutant concentrations meet the standard in question over a designated period of time.

Unclassified – assigned to areas were data are insufficient to determine whether a pollutant is violating the standard in question.

Table 1.3-1. Federal and State Attainment Status of Butte County

POLLUTANT	STATE DESIGNATION	FEDERAL DESIGNATION
1-hour ozone	Nonattainment	-
8-hour ozone	Nonattainment	Nonattainment
Carbon monoxide	Attainment	Attainment
Nitrogen Dioxide	Attainment	Attainment
Sulfur Dioxide	Attainment	Attainment
24-Hour PM10	Nonattainment	Attainment
24-Hour PM2.5	No Standard	Attainment
Annual PM10	Attainment	No Standard
Annual PM2.5	Nonattainment	Attainment

Source: Butte County AQMD, 2018

Sensitive Receptors

Sensitive receptors are frequently occupied locations where people who might be especially sensitive to air pollution are expected to live, work, or recreate. These types of receptors include residences, schools, churches, health care facilities, convalescent homes, and daycare centers. The project site is located in a rural area with residential uses on parcel sizes between 5 and 200 acres. Table 1.3-2 lists sensitive receptors that were identified in the project vicinity and the distances from the project site.

Table 1.3-2. Sensitive Receptors in the Project Vicinity

SENSITIVE RECEPTORS	DISTANCE FROM PROJECT SITE TO RECEPTOR
Residence (1195 Oroville-Chico Hwy)	1,100 feet northwest
Residence (1269 Mesa Road)	1,350 feet northwest
Residence (898 Oroville-Chico Hwy)	425 feet south*
Residence (1251 Oroville-Chico Hwy)	1,975 feet northwest
Source: Butte County Geographical Information System/Google Earth imagery	

* The existing residence located at 898 Oroville-Chico Highway is situated approximately 425 feet south of the property line of the Old Durham Wood facility, and directly south of the discharge field of the facility. The facility's operation area is approximately 2,580 feet north of the residence.

<u>Butte County Air Quality Management District</u>

The Butte County Air Quality Management District (BCAQMD) is the local agency with primary responsibility for compliance with both the federal and state standards and for ensuring that air quality conditions are maintained. They do this through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues.

Activities of the BCAQMD include the preparation of plans for the attainment of ambient air quality standards, adoption and enforcement of rules and regulations concerning sources of air pollution, issuance of permits for stationary sources of air pollution, inspection of stationary sources of air pollution and response to citizen complaints, monitoring of ambient air quality and meteorological conditions, and implementation of programs and regulations required by the FCAA and CCAA.

According to the State CEQA Guidelines, the significance criteria established by the applicable air quality management or air pollution control district may be relied on to make significance determinations for potential impacts on environmental resources. BCAQMD is responsible for ensuring that state and federal ambient air quality standards are not violated within Butte County. Analysis requirements for construction and operation-related pollutant emissions are contained in BCAQMD's *CEQA Air Quality Handbook: Guidelines for Assessing Air Quality and Greenhouse Gas Impacts for Projects Subject to CEQA Review*. Established with these guidelines are screening criteria to determine whether or not additional modeling for criteria air pollutants is necessary for a project. The CEQA Air Quality Handbook also contains thresholds of significance for construction-related and operation-related emissions: ROG, NOx and PM10 (Table 1.3-5). The screening criteria listed in Table 1.3-4 were created using CalEEMod version 2013.2.2 for the given land use types. To determine if a proposed project meets the screening criteria, the size and metric for the land use type (units or square footage) should be compared with that of the proposed project. If a project is less than the applicable screening criteria, then further quantification of criteria air pollutants is not necessary, and it may be assumed that the project would have a less than significant impact on criteria air pollutants. If a project exceeds the size provided by the screening criteria for a given land use type then additional modeling and quantification of criteria air pollutants should be performed (Butte County Air Quality Management District 2014).

Table 1.3-4. Screening Criteria for Criteria Air Pollutants

LAND USE TYPE	MAXIMUM SCREENING LEVELS FOR PROJECTS
Single-Family Residential	30 Units
Multi-Family (Low Rise) Residential	75 Units
Commercial	15,000 square feet
Educational	24,000 square feet
Industrial	59,000 square feet
Recreational	5,500 square feet
Retail	11,000 square feet
Source: Butte County AQMD, CEQA Air Quality Handbook, 2014	

Table 1.3-5. Butte County Air Quality Management District Criteria Pollutant Emissions Thresholds

POLLUTANT	CONSTRUCTION	OPERATION
ROG	137 pounds/day, not to exceed 4.5 tons/year	25 pounds/day
NOX	137 pounds/day, not to exceed 4.5 tons/year	25 pounds/day
PM < 10 microns	80 lbs./day	80 lbs./day
Source: Table ES-2 - Butte County Air Quality Management District 2014		

NOX = nitrogen oxides

PM = particulate matter

ROG = reactive organic gases

Discussion

a) Conflict with or obstruct implementation of the applicable air quality plan?

Less than significant impact. A project is deemed inconsistent with an air quality plan if it would result in population or employment growth that exceeds the growth estimates in the applicable air quality plan (i.e., generating emissions not accounted for in the applicable air quality plan emissions budget). Therefore, proposed projects need to be evaluated to determine whether they would generate population and employment growth and, if so, whether that growth would exceed the growth rate included in the applicable air quality plan.

The project has not induced population growth. The current Use Permit estimated that the facility would employ between 19 to 28 employees. However, operations currently require 12 to 28 employees. The proposed expansion is anticipated to increase the amount of employees to between 25 to 46 employees. Employees are drawn from the local workforce. The project is consistent with the agricultural zoning of the property. Consequently, the project has been included in the County's General Plan and accounted for in the region's clean air plan. Further, while the proposed project generates relatively minor amounts of emissions associated with construction activities, off-road equipment, increased on-road trips and employee trips, these emissions are not anticipated to exceed the emission's budget from the applicable air quality plan.

b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?

Less than significant impact with mitigation. The project has the potential to generate both short-term construction-related emissions from expansion activities and long-term operational emissions generated by increased processing of materials and traffic accessing the site. Butte County is currently in nonattainment for the State and Federal 8-hour ozone standards, the State 1-hour ozone standard, and the state 24-hour PM10 and annual PM2.5 standards

Construction

During construction, criteria air pollutant emissions are temporarily and intermittently generated from a variety of sources. Project-related excavation and site grading activities for future construction would generate fugitive particulate matter (PM) dust emissions. Fugitive dust emissions are primarily associated with ground disturbance and material transport and vary as a function of parameters such as soil silt content and moisture, wind speed, extent of disturbance area, and the intensity of activity performed with construction equipment. Exhaust emission from diesel equipment, material transport trips, and construction worker-commute trips will also contribute to short-term increase in PM emissions, but to a lesser extent. Construction will involve the use of equipment and paving materials that would emit ozone precursors (i.e., reactive organic gases or ROG, and nitrogen oxides, or NOx). Construction activities would also result in the emission of other criteria pollutants from equipment exhaust, construction-related vehicular activity, and construction worker automobile trips. Emission levels for these activities vary depending on the number and type of equipment, duration of use, operation schedules, and the number of construction workers. Criteria pollutant emissions of ROG and NOx from these emission sources incrementally add to the regional atmospheric loading of ozone precursors during the proposed construction.

Construction activities are anticipated to cause PM10 emissions from fugitive dust to exceed BCAQMD construction thresholds. The BCAQMD requires the use of specific construction dust mitigation measures to reduce PM10 emissions during construction. These measures focus on minimizing emissions associated with land clearing/earth moving, visibly dry disturbance soil surface areas, paved road track-out, visibly dry disturbed unpaved roads, and soil piles. The BCAQMD also requires the use of specific mitigation measures that are intended to mitigate combustion emissions from heavy-duty construction equipment. Implementation of the BCAQMD construction mitigation measures would reduce project-related construction emissions to a less than significant level.

Operation

The proposed project will also result in long-term criteria air pollutant emissions from the anticipated increase in on-road vehicles trips, increased use of off-road equipment and increased processing of materials. The project will result in additional processing of material onsite as well as increase the amount of vehicles and trucks using the site. Estimated existing and proposed traffic volumes are included in Table 1.17-2 in Section 1.17 (Transportation/Traffic). Existing traffic volumes were estimated from the volumes contained in the IS/MND document prepared for UP14-0002. Based on information from the applicant, the project is estimated to result in an increase of 5 passenger vehicles (10 one-way trips) and 22 additional trucks (44 one-way truck trips) using the site each operational day. Although the project will result in additional traffic, the project will no longer receive green waste material from the North Area Recovery Station (NARS) located in Sacramento, therefore the average trip length of trucks trips delivering materials at the site will be lower than what was analyzed in the IS/MND for UP14-0002.

Increased vehicle emissions that could be generated by the project were estimated using EMFAC 2017 emission rates. The project is estimated to generate an increase of 22 trucks per day (44 one way trips per day) and 5 passenger vehicles (10 one-way trips) per day. Emissions were estimated assuming an average speed of 55 mph, an average round trip distance of 75 miles, and Medium-Heavy Duty Diesel Public Fleet Truck vehicle category for the additional commercial trucks using the site and the Light Duty Truck vehicle category for the additional passenger vehicles using the site. As shown in Table 1.3-6, the additional transportation emissions generated by the project are not anticipated to exceed Butte County Air Quality Management District Criteria Pollutant Emissions Thresholds for operational emissions.

Table 1.3-6: Estimated Increase in Transportation Emissions			
Pollutant	**Lbs/day (Trucks)**	**Lbs/day (passenger vehicles)**	**(Lbs/day) Total**
ROG	0.11	0.03	0.13
NOx	14.9	0.14	15.0
PM_{10}	0.09	0.002	0.10

The expansion of the operational area will allow additional room onsite for safety to establish larger buffer zones between the different working zones. The expansion will not result in a significant increase in the equipment operated onsite. The project will require the use of an additional grinder and well as 2 additional front-wheel loaders in addition to equipment onsite that was included in UP14-0002. Emissions generated by these additional pieces of equipment will be negligible, and will not exceed Butte County Air Quality Management District Criteria Pollutant Emissions Thresholds for operational emissions.

The increased emissions generated by the project are not expected to exceed Butte County thresholds for ROG and NOx, however material processing, movement, and onsite dust are anticipated to cause PM10 emissions to exceed BCAQMD's operational thresholds. To ensure implementation of effective and comprehensive control measures for fugitive dust emission to reduce potential air quality impacts from construction activities and proposed operations to a less than significant level, **Mitigation Measures AIR-1 through AIR-4**, listed below, is recommended.

c) Expose sensitive receptors to substantial pollutant concentrations?

Less than significant impact with mitigation. Sensitive receptors in the project area and their distances from the project site are contained in Table 1.3-2. Expansion of the facility will occur to the north and east, toward Highway 99 and vacant land. An evaluation of the project area revealed that the nearest sensitive receptor is a single-family residence located approximately 1,000 feet southwest of the proposed expansion boundary. The residence is currently 1,100 feet northwest from the current facility boundary.

Construction and operational activities generate emissions of criteria pollutants, including suspended and inhalable particulate matter and equipment exhaust emissions. These emissions have the potential to expose nearby sensitive receptors to pollutant concentrations, if these sensitive receptors are located within 1,000 feet of the emission source. Sensitive receptors include residences, hospitals, nursing homes, day care centers, schools, and churches. Because the nearest receptor is located 1,000 feet from the project boundary and even further from emission sources onsite, together with the implementation of **Mitigation Measures AIR-1 through AIR-4**, potential impacts from criteria pollutants would not exceed the significance thresholds recommended by the County and BCAPMD.

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

Less than significant impact with mitigation. Butte County Air Quality Management District's District Rule 200, is the basis for establishing a threshold for odor impacts. A project may reasonably be expected to have a significant adverse odor impact where it were to "discharge from any non-vehicular source such quantities of air contaminants or other materials which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public or which endangered the comfort, repose, health or safety of any such persons or the public or which cause or have a natural tendency to cause injury or damage to business or property."

Composting facilities have the potential to generate substantial amounts of odors due to the generation of ammonia and hydrogen sulfide as by-products of the composting process. Composting is the biological decomposition of organic matter under controlled conditions. Decomposition that takes place in the absence of oxygen (i.e., anaerobic decomposition) produces more pungent odors. Under anaerobic conditions methane gas, carbon dioxide, and sulfur compounds are produced. Odors due to the anaerobic decay are generally the odors of concern when handling organic waste material.

The BCAQMD has identified screening distance trigger levels for various types of land uses typically associated with odors, including composting facilities. For composting facilities, the screening distance is 2 miles. If a project would locate receptors and known odor sources in proximity to each other (up to two miles) further analysis is recommended. If a project would not locate receptors and known odor sources in proximity to each other, then further analysis is not warranted.

An evaluation of the project area and the surrounding receptors in terms of the guidance provided by BCAQMD indicates that the nearest sensitive receptor to the project site is located approximately 1,000 feet from the project site, with multiple more receptors (e.g. occupied businesses and residences) located within two miles of the project site. The project will not move activities closer to these receptors.

For projects triggering the Districts screening level distances, the BCAQMD indicates that the assessment of odor complaints received against a facility should be undertaken to determine odor impacts. A facility would result in a significant odor impact if the BCAQMD has received more than one confirmed complaint per year averaged over a 3-year period, or three unconfirmed complaints per year averaged over a 3-year period. According to the operator of the facility, the facility has not received any odor complaints in the last four years. The project does not include any new sources of odors or site odor sources closer to existing sensitive receptors. While no complaints have been received against the current facility operations, the facility has the potential to generate significant odor impacts to nearby sensitive receptors. To reduce potential odor impacts to a less than significant level, **Mitigation Measure AIR-5** continues to be implemented.

Mitigation Measures

<u>Mitigation Measure AIR-1</u>

The following best practice measures to reduce impacts to air quality shall be incorporated by the project applicant, subject property owners, or third-party contractors during construction activities on the project site. These measures are intended to reduce criteria air pollutants that may originate from the site during the course of land clearing and other construction operations.

<u>Diesel PM Exhaust from Construction Equipment and Commercial On-Road Vehicles Greater than 10,000 Pounds</u>

- All on- and off-road equipment shall not idle for more than five minutes. Signs shall be posted in the designated queuing areas and/or job sites to remind drivers and operators of the five-minute idling limit.
- Idling, staging and queuing of diesel equipment within 1,000 feet of sensitive receptors is prohibited.
- All construction equipment shall be maintained in proper tune according to the manufacturer's specifications. Equipment must be checked by a certified mechanic and determined to be running in proper condition before the start of work.
- Install diesel particulate filters or implement other CARB-verified diesel emission control strategies.
- Shall not operate a diesel-fueled auxiliary power system (APS) to power a heater, air conditioner, or any ancillary equipment on that vehicle during sleeping or resting in a sleeper berth for greater than 5 minutes at any location when within 100 feet of a restricted areas.
- To the extent feasible, truck trips shall be scheduled during non-peak hours to reduce perk hour emissions.

<u>Operational TAC Emissions</u>

- All mobile and stationary Toxic Air Contaminants (TACs) sources shall comply with applicable Airborne Toxic Control Measures (ATCMs) promulgated by the CARB throughout the life of the project (see https://ww2.arb.ca.gov/resources/documents/airborne-toxic-control-measures).
- Stationary sources shall comply with applicable District rules and regulations.

Fugitive Dust

Construction activities can generate fugitive dust that can be a nuisance to local residents and businesses near a construction site. Dust complaints could result in a violation of the District's "Nuisance" and "Fugitive Dust" Rules 200 and 205, respectively. The following is a list of measures that may be required throughout the duration of the construction activities:

- Reduce the amount of the disturbed area where possible.
- Use of water trucks or sprinkler systems in sufficient quantities to prevent airborne dust from leaving the site. An adequate water supply source must be identified. Increased watering frequency would be required whenever wind speeds exceed 15 mph. Reclaimed (non-potable) water should be used whenever possible.
- All dirt stockpile areas should be sprayed daily as needed, covered, or a District approved alternative method will be used.
- Permanent dust control measures identified in the approved project revegetation and landscape plans should be implemented as soon as possible following completion of any soil disturbing activities.
- Exposed ground areas that will be reworked at dates greater than one month after initial grading should be sown with a fast-germinating non-invasive grass seed and watered until vegetation is established.
- All disturbed soil areas not subject to re-vegetation should be stabilized using approved chemical soil binders, jute netting, or other methods approved in advance by the Butte County Air Quality Management District.
- All roadways, driveways, sidewalks, etc. to be paved should be completed as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used.
- Vehicle speed for all construction vehicles shall not exceed 15 mph on any unpaved surface at the construction site.
- All trucks hauling dirt, sand, soil, or other loose materials are to be covered or should maintain at least two feet of freeboard (minimum vertical distance between top of load and top of trailer) in accordance with local regulations.
- Install wheel washers where vehicles enter and exit unpaved roads onto streets, or wash off trucks and equipment leaving the site.
- Sweep streets at the end of each day if visible soil material is carried onto adjacent paved roads. Water sweepers with reclaimed water should be used where feasible.
- Post a sign in prominent location visible to the public with the telephone numbers of the contractor and the Butte County Air Quality Management District - (530) 332-9400 for any questions or concerns about dust from the project.

All fugitive dust mitigation measures required should be shown on grading and building plans. In addition, the contractor or builder should designate a person or persons to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust offsite. Their duties shall include holidays and weekend period when work may not be in progress. The name and telephone number of such persons shall be provided to the District prior to land use clearance for map recordation and finished grading of the area.

Please note that violations of District Regulations are enforceable under the provisions of California Health and Safety Code Section 42400, which provides for civil or criminal penalties of up to $25,000 per violation.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-2:

The applicant shall implement the following mitigation measures to mitigate combustion emissions from heavy-duty construction equipment.

- Maintain all off-road equipment in proper tune and regularly serviced according to manufacturer's specification.
- Meet, or exceed to the extent feasible, State On-Road and Off-Road emission standards for heavy-duty engines.
- Electrify equipment where feasible.
- Substitute gasoline-powered in place of diesel-powered equipment, where feasible.
- Use alternative fueled construction equipment on site where feasible, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane, or biodiesel.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-3:

The applicant shall follow sound composting management practices, including maintaining moisture, temperature and pH levels, and proper aerating, turning and mixing the composting materials. Specifically, the following practices will help minimize the generation and dispersal of dust and fungus spores during composting operations and thus limit exposure:

- Refrain from turning, screening, or loading activities on windy days;
- Use water spray or mists during grading, screening, and pile turning activities;
- Maintain proper moisture levels in active composting piles;
- Maintain good housekeeping practices, including site cleanliness;
- Provide employee training and the use of personal protective equipment.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-4:

The applicant shall implement the following standard measures as outlined in the *BCAQMD CEQA Air Quality Handbook Guidelines*:

- Increase building energy efficiency rating by 10 percent above what is required by Title 24 requirements. This can be accomplished in a number of ways (increasing attic, wall or floor insulation, etc.)
- Improvement of thermal efficiency of structures as appropriate by reducing thermal load with automated and timed temperature controls, or occupancy load limits.

- Incorporate shade trees, adequate in number and proportional to the project size, throughout the project site to reduce building heating and cooling requirements.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-5:

The applicant shall adhere to the odor management practices in the approved Odor Impact Minimization Plan, formulated in accordance with State composting regulations (Title 14 CCR §17863.4.). This plan will be updated and submitted to the Local Enforcement Agency (LEA) as part of the application for a Solid Waste Facilities Permit (SWFP) for the facility's operations and implemented upon issuance of the SWFP. In accordance with the above-cited regulations, the plan shall contain, at a minimum:

- An odor monitoring protocol which describes the proximity of possible odor receptors and a method for assessing odor impacts at the location of possible odor receptors.
- A description of meteorological conditions effecting migration of odors and/or transport of odor-causing material offsite. Seasonal variations that effect wind velocity and direction shall also be described.
- A compliant response protocol that includes the verification and documentation upon receipt of any odor complaints and immediate notification of County LEA staff upon receipt of any odor complaints upon receipt of the call.
- A description of design considerations and/or projected ranges of optimal operation to be employed in minimizing odor, including method and degree of aeration, moisture content of materials, feedstock characteristics, airborne emission production, process water distribution, pad and site drainage and permeability, equipment reliability, personnel training, weather event impacts, utility service interruptions, and site specific concerns.
- A description of operating procedures for minimizing odor, including aeration moisture management, feedstock quality, drainage controls, pad maintenance, wastewater pond controls, storage practices (e.g., storage time and pile geometry), contingency plans (i.e. equipment, water, power, and personnel), biofiltration, and tarping.
- The odor impact minimization plan shall be revised to reflect any changes to operating or program conditions, and a copy shall be provided to the LEA within 30 days of those changes.
- The odor impact minimization plan shall be reviewed annually by the operator to determine if any revisions are necessary.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Butte County Environmental Health shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

1.4 BIOLOGICAL RESOURCES

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. Biological Resources.				
Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?	☐	☒	☐	☐
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☒	☐	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Environmental Setting

The project site is located in an established agricultural area of Butte County, within the northern Sacramento Valley. The project site has been utilized for livestock grazing and facility operations and most, if not all, of the native vegetation has been altered. Gallaway Enterprises prepared a general biological resource assessment (BRA) for 52 acres of project site in February 2014. The BRA characterized the project site as *Annual Grassland* with mound-swale topography. The additional areas of the project site and proposed expansion area of the site also consists of annual grassland habitat with lava cap and mound-swale topography.

Annual Grassland

Annual grassland consists mostly of annual grasses and forbs, such as medusahead grass, soft chess, and yellow star thistle. Common wildlife species that are found breeding in this habitat include a variety of ground nesting avian species and small mammals, reptiles and amphibians. However, due to the thin soils present, the annual grassland within the project site does not support breeding habitat for most ground burrowing avian or mammal species.

Jurisdictional Waters of the United States and State of California, including Wetlands

Waters of the United States (U.S.), including wetlands, are broadly defined to include navigable waterways, and tributaries of navigable waterways, and adjacent wetlands. Although definitions vary to some degree, wetlands are generally considered to be areas that are periodically or permanently inundated by surface water or groundwater, supporting vegetation adapted to life in saturated soil. Jurisdictional wetlands are vegetated areas that meet specific vegetation, soil, and hydrologic criteria defined by the U.S. Army Corps of Engineers (USACE). The USACE holds sole authority to determine the jurisdictional status of Waters of the U.S., including wetlands. Jurisdictional wetlands and Waters of the U.S. include, but are not limited to, perennial and intermittent creeks and drainages, lakes, seeps, and springs; emergent marshes; riparian wetlands; and seasonal wetlands. Wetland and waters of the U.S. provide critical habitat components, such as nest sites and reliable source of water for a wide variety of wildlife species.

Multiple wetland delineations have been conducted at the project site since 2013. A Delineation of Waters of the United States for a portion of the project site was originally prepared for UP14-0002 by Gallaway Enterprises in October 2013 and an approved Jurisdictional determination for the property issued by US Army Corps of Engineers on June 5, 2017. An Updated Draft Delineation was submitted to ACOE by VESTRA in February 2020 to revise the 2013 delineation. Portions of the area included in the 2013 delineation had been impacted by fuel breaks constructed by CAL FIRE across a 19-acre area adjacent to the Old Durham Wood facility in response to a wildfire in 2017.

Changes to the site occurred in late March and early April 2017 involving expansion of the operational area of the composting facility. The existing facility was approximately 30 acres and the facility was expanded to create an additional 30 acres of operational area to the northeast. During the course of the expansion, seasonal wetlands in the center of the property were impacted. These wetlands were later considered Non-jurisdictional Waters of the U.S., as they were originally created by a constructed berm, located on the eastern side of the original operating area that trapped water flowing off of a large natural onsite knoll.

The existing berm was constructed around the boundary of the 2017 expansion area in late 2017 to retain stormwater onsite, impacting 0.24 acres of seasonal wetland in the northeast portion of the property. The wetland was considered a Jurisdictional Waters of the U.S. The impacted wetland features have since been repaired. In addition Old Durham Wood was required to purchase 0.4 acres of vernal pool establishment credits at the Meridian Ranch Mitigation bank.

The additional proposed expansion area of the project site was included in a delineation prepared by Gallaway Enterprises in February 2017 and by VESTRA in 2020. Existing aquatic features on the proposed project site are shown on Figure 3. The proposed expansion area of the project contains 0.13 acres of vernal pools, 0.15 acres of vernal swales, 0.03 acres of seasonal swales, 0.016 acres of seasonal pools and 0.12 acres of other waters for a total of 0.44 acres of potentially impacted waters. The delineations have been submitted to the ACOE for a jurisdictional determination. The waters are also likely to be determined to be jurisdictional waters of the state. The loss of 0.44 acres of waters will be mitigated by the purchase of credits at an off-site mitigation bank specified by the agencies at the mitigation ratio specified by the ACOE or RWQCB

An additional 0.48 acres of wetland impacts were associated with the road reconstruction and construction undertaken during summer 2020 in the rice check filtration area. Jurisdictional determination is pending. As above, mitigation will be completed off-site by the purchase of credits at an approved mitigation bank and at the mitigation ratio specified by either the ACOE or the RWQCB.

Special-Status Species

Many species of plants and animals within the State of California have low populations, limited distributions, or both. Such species may be considered "rare" and are vulnerable to extirpation as the state's human population grows and the habitats these species occupy are converted to agricultural and urban uses. A sizable number of native species and animals have been formally designated as threatened or endangered under State and Federal endangered species legislation. Others have been designated as "Candidates" for such listing and the California Department of Fish and Game (CDFG) have designated others as "Species of Special Concern". The California Native Plant Society (CNPS) has developed its own lists of native plants considered rare, threatened or endangered. Collectively, these plants and animals are referred to as "special status species."

Various direct and indirect impacts to biological resources may result from the small amount of development enabled by the project, including the loss and/or alteration of existing undeveloped open space that may serve as habitat. Increased vehicle trips to and from the project site can result in wildlife mortality and disruption of movement patterns within and through the project vicinity. Disturbances such as predation by pets (e.g., cats and dogs) and human residents may also occur at the human/open space interface, while conversion of land from lower to higher density residential use can lead to a predominance of various urban-adapted wildlife species (e.g., coyotes, raccoons, ravens and blackbirds) that have been observed to displace more sensitive species.

California Environmental Quality Act Guidelines Section 15065 requires a mandatory finding of significance for projects that have the potential to substantially degrade or reduce the habitat of a threatened or endangered species, and to fully disclose and mitigate impacts to special status resources. For the purposes of this Initial Study, the California Environmental Quality Act (Public Resources Code Sections 21083 and 21087,) defines mitigation as measure(s) that:

- Avoids the impact altogether by not taking a certain action or parts of an action.
- Minimizes impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifies the impact by repairing, rehabilitating, or restoring the impacted environment.
- Reduces or eliminates the impact over time by preservation and maintenance operations during the life of the project.
- Compensates for the impact by replacing or providing substitute resources or environments.

The Biological Resource Assessment prepared by Gallaway Enterprises in 2014 for a 52-acre portion of the project site compiled a list of special-status species that have a potential to occur within the vicinity of the project site and/or have suitable habitat and/or recorded observations within or within close proximity of the project

An updated search of the California Natural Diversity Database (CNDDB) was conducted for the project site (including proposed expansion area) in 2020. CNDDB Occurrences documented within and one and five mile radius of the project site are included on Figure 4. As shown on Figure 4, there are no documented occurrences of special status species within the boundaries of the project. Special status-wildlife species occurrences within 5 miles of the project site include:

- American peregrine falcon (*Falco peregrinus anatum*)
- Burrowing owl (*Athene cunicularia*)
- Chinook Salmon-Central Valley spring-run ESU (*Oncorhynchus tshawytscha* pop. 6)
- Foothill yellow-legged frog (*Rana boylii*
- North American Porcupine (*Erethizon dorsatum*)
- Steelhead- Central Valley DPS (*Oncorhynchus mykiss irideus* pop. 11
- Swainson's hawk (*Buteo swainsoni*)
- Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)
- Vernal pool tadpole shrimp (*Lepidurus packardi*)
- Western mastiff bat (*Eumops perotis californicus*)
- Western pond turtle (*Emys marmorata*)

Special-status plant species documented occurrences within 5 miles of the project site include:

- Adobe-lily (*Fritillaria pluriflora*)

- Control Point
- Parking
- Pipeline
- Fire System Water Pipes and Hydrants
- Berm

Impacted Waters of the U.S.

- Non-Relatively Permanent Water (0.116 acres and 1,003 linear feet)
- Seasonal Pool (0.016 acres)
- Seasonal Swale (0.030 acres)
- Vernal Pool (0.128 acres)
- Vernal Swale (0.148 acres)

- Fuel Break
- Proposed Expansion Boundary (63.9 acres)
- Retention Pond
- Buildings
- Approximate Parcel Boundary

N

Date Prepared: September 16, 2020
Prepared by: J. Williams, VESTRA Resources, Inc.

0 175 350 700 Feet
1 inch = 350 feet

Note: All fills within expansion boundary will be permanent

VESTRA

SOURCE: MAXAR FEBRUARY 11, 2019, AERIAL PHOTOGRAPH

FIGURE 3
EXPANSION IMPACTS TO
WATERS OF THE U.S.
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

P:\GIS\71730\Figures\2020 Expansion\ACOE\71730_ExpansionImpactsToWOUS.mxd

- Big-scale balsomroot (*Balsamorhiza macrolepis*)
- Butte County checkerbloom (*Sidalcea robusta*)
- Butte County fritillary (*Fritillaria eastwoodiae*)
- Butte County meadowfoam (*Limnanthes floccosa ssp. Californica*)
- Greene's tuctoria (*Tuctoria greenei*)
- Hoover's spurge (*Euphorbia hooveri*)
- Pink creamsacs (*Castilleja rubicundula var. rubicundula*)
- Slender-leaved pondweed (*Stuckenia filiformis ssp. alpina*)
- Veiny monardella (*Monardella venosa*)
- Woolly rose-mallow (*Hibiscus lasiocarpos var. occidentalis*)

Great Valley Cottonwood Riparian Forest, Great Valley Mixed Riparian Forest, and Great Valley Valley Oak Riparian Forest habitats occur within five miles of the project site, but not within the project site. Northern Hardpan Vernal Pool habitat also occurs within five miles of the project site.

According to the U.S. Fish and Wildlife Service Information for Planning and Consultation (IPAC) database list for the project site, the following threatened or endangered species are potentially affected by activities at the project site: Giant garter snake (*Thahmnophis gigas*), California red-legged frog (*Rana draytonii*), Delta smelt (*Hypomesus transpacificus*), Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), Conservancy fairy shrimp *(Branchinecta conservatio)*, vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*), Greene's tuctoria (*Tuctoria greenei*), hairy Orcutt Grass (*Orcuttia pilosa*) and Hoover's spurge (*Chamaesyce hooveri*). The project site is located within USFWS Critical Habitat for vernal pool tadpole shrimp.

Discussion

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?

Less than Significant with Mitigation Incorporated. The current operational boundary of the facility has been disturbed and paved, therefore there is no potential for any special status plant species to occur on this portion of the project site.

The proposed expansion area of the site contains habitats that have the potential to support the following special-status plant species; Butte County Meadowfoam (*Limnanthes floccosa* ssp. *californica*), Boggs Lake Hedge Hyssop (*Gratiola heterosepala*), and Red Bluff dwarf rush (*Juncus leiospermus*). A rare plant survey of the expansion area was conducted by VESTRA on March 20, 2020, during the appropriate flowing window and none of the potentially occurring plant species were found during the survey. The results of the survey are included in Appendix B. Since the proposed expansion area has been surveyed and does not include special status plant species, the project will have no impact related to special-status plant species.

The road maintenance and construction on the southern rice checks resulted in the impacts to 0.48 acres of wetland habitat. The area had been surveyed for the delineation work and brachiopods were not noted in the pools impacted. A survey for rare plants was completed at the time the delineation was completed and none were found.

The current aquatic resources on the proposed expansion, identified in delineations conducted for the project, are included on Figure 3. As shown on Figure 3, the proposed expansion area of the site contains vernal pool, vernal swales, seasonal swales, seasonal pools and other Waters of the U.S.

Seasonal swales are low tracts of land that carry surface water during certain times of year and commonly support vernal pools. Vernal pools are identified by U.S. Fish and Wildlife Service (USFWS) as critical habitat for the Vernal Pool Tadpole Shrimp *(Lepidurus packardi)*, which is listed as Federally-endangered. Vernal pools also host Conservancy Fairy Shrimp *(Branchinecta conservatio)*, which is listed by USFWS as Federally-endangered, and Vernal Pool Fairy Shrimp *(Branchinecta lynchi)*, which is listed by USFWS as Federally-threatened. Vernal pools were identified on the northeast portion of the property in 2013. Additional vernal pools were identified onsite since the 2013 Draft Delineation due to the habitat being supported by project features that were constructed in 2015. This vernal pool habitat onsite was impacted by the 2017 expansion, during which the berm was relocated farther northeast. The proposed additional expansion of the facility will result in additional impacts to 0.13 acres of vernal pool habitat as well as 0.15 acres of vernal swales, 0.03 acres of seasonal swales, 0.016 acres of seasonal pools and 0.12 acres of other Waters of the U.S or State of California for a total of 0.44 acres.

In addition, during reconstruction of the access roads on the rice check filtration area 0.48 acres of wetland features were impacted. **Mitigation Measure BIO-3** is suggested to restore or compensate for the project impacts to vernal pool habitat and other Waters of the U.S. / Waters of the state.

Due to the lack of trees, shrubs, rock outcroppings, or crevices, there is no suitable nesting habitat for bats, raptors or migratory bird species that require these habitat components for nesting. Additionally, the thin soils present on the project site preclude the potential for ground-borrowing avian species. Though the project site lacks many of the elements that support avian species, the grassland habitat provide foraging and nesting opportunities for some species such as peregrine falcon and Swainson's hawk. To insure that proposed grading activities do not impact the species using the project site for foraging or nesting, **Mitigation Measure BIO-2** is recommended.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?

Less than Significant with Mitigation Incorporated. See discussion 1.4(a) – *Biological Resources*.

c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Less than Significant with Mitigation Incorporated. Changes to the site occurred in late March and early April 2017 involved expanding the operational area of the composting facility. The existing facility was approximately 30 acres and the facility was expanded to create an additional 30 acres of operational area to the northeast. During the course of the expansion, seasonal wetlands in the center of the property were impacted. These wetlands were later considered Non-Jurisdictional Waters of the U.S.; they were originally created by a constructed berm, located on the eastern side of the original operating area that trapped water flowing off of a large natural onsite knoll.

The existing berm was constructed around the boundary of the expansion area in late 2017 to retain stormwater onsite, impacting an additional seasonal wetland in the northeast portion of the property which has since been repaired. This 0.24 acre wetland was considered a Jurisdictional Waters of the U.S. 0.4 acres of mitigation credits were purchased off site at the Meridian Ranch Mitigation Bank to mitigate for the impacted features. The impacted wetland features have since been repaired.

The proposed future expansion area will result in impacts to additional aquatic resources. The aquatic resources within the proposed expansion area are included on Figure 3. Aquatic resources within the expansion include vernal pools, vernal swales, and other Waters of the U.S. Revised **Mitigation Measure BIO-3**, mitigation through habitat compensation, is recommended.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

No Impact. The project site is not located within the Butte County migratory deer corridors. No major migratory routes or corridors have been designated through the project site, and the existing developed components of the project area (i.e. roads and fenced parcels) typically preclude use of the area as a migratory wildlife corridor for large mammals. However, the site may facilitate home range and dispersal movement of resident wildlife species, including birds, small mammals and other wildlife.

Development of the project site would not restrict regional wildlife movement or wildlife migration patterns primarily due to the large density of the subject property and surrounding area, which provide migrating wildlife an opportunity to avoid obstructions.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

No impact. No trees are located in the project site. Therefore, no conflict with local with any local policies or ordinances protecting biological resources such as a tree preservation policy ordinance is anticipated.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

No impact. The Butte Regional Conservation Plan (BRCP) is a joint Habitat Conservation Plan (HCP)/National Community Conservation Plan (NCCP) that is currently being prepared for the western half of the Butte County. In the event the BRCP is adopted, individual projects and development that occur in the BRCP planning area would need to be coordinated with the Butte County Association of Governments to ensure that the project does not conflict with the BRCP. As the plan has not been adopted, the proposed project will not conflict, nor interfere with, the attainment of the goals of the proposed plan.

Mitigation Measures

Mitigation Measure BIO-1

Prior to grading activities, the applicant shall retain a qualified biologist to conduct protocol-level surveys during the appropriate flowering window for Red Bluff dwarf rush (March – June), Ahart's paronychia (February – June), Butte County golden clover (March – May), and Butte County meadowfoam (March – May). Surveys shall be in compliance with survey protocols for plants species listed under the California Endangered Species Act and Federal Endangered Species Act. A report summarizing the findings of surveys will be prepared and submitted to the County and the California Department of Fish and Wildlife. In the event sensitive species are identified on the project site, the biologist shall consult with the California Department of Fish and Game, and the United States Fish and Wildlife Service, to determine appropriate measures to reduce the impact of identified species to a less than significant level.

Plan Requirements: Perform protocol-level surveys for plants stated above.

Timing: Requirements of the condition shall be adhered to prior to and during construction activities planned to occur during (between March and May).

Monitoring: The Butte County Department of Development Services shall ensure the condition is met at the time of construction activities.

Mitigation Measure BIO-2

If project construction activities, including ground disturbance or vegetation removal occur during the nesting season for birds protected under the Migratory Bird Treaty Act (MBTA) and California Department Fish & Game Code (CDFC) (approximately February 1 – August 31), the project proponent shall retain a qualified biologist to perform preconstruction surveys for nesting bird species. Surveys to identify active bird nests shall be conducted within and 250 feet around the footprint of proposed construction site. The survey shall be conducted within 7 days prior to the initiation of construction activities. In the event that an active nest is observed, a species protection buffer shall be established. The species protection buffer will be defined by the qualified biologist based on the species, nest type and tolerance to disturbance. Construction activity shall be prohibited within the buffer zones until the young have fledged or the nest fails. Nests shall be monitored by a qualified biologist once per week and a report submitted to the Butte County Department of Development Services.

Plan Requirements: Perform protocol-level surveys for migratory birds protected by the California Department Fish & Game Code and the Migratory Bird Treaty Act.

Timing: Requirements of the condition shall be adhered to prior to and during construction activities planned to occur during nesting seasons for CDFC and MBTA species (between February 1 and August 31).

Monitoring: The Butte County Department of Development Services shall ensure the condition is met at the time of construction activities.

Mitigation Measure BIO-3

The project will result in adverse impacts to Jurisdictional Waters of the United States (U.S.) or Waters of the State. Prior to future development activities associated with the Project, the project proponent shall obtain the appropriate permits from the United States Army Corp of Engineers (ACOE) and California Regional Water Quality Control Board (RWQCB) for delineated wetland areas disturbed by past and future grading activities. Mitigation of impacted wetlands shall include the purchase of compensatory mitigation credits in order to achieve zero net loss of vernal swale/vernal pool habitat. ACOE and RWQCB will determine jurisdiction and mitigation ratios. All mitigation will be completed using off-site mitigation through the purchase of credits at a mitigation bank approved by the agency.

Plan Requirements: The United States Army Corp of Engineers (ACOE) and California Regional Water Quality Control Board (RWQCB) shall verify impacted wetland areas. Upon verification, applicable permits and other regulatory requirements shall be obtained by the project proponent. Affected agencies shall determine the appropriate ratio of offsite compensatory mitigation credits to purchase for impacted wetlands.

Timing: Requirements of the condition shall be satisfied prior to any development activity associated with the Project.

Monitoring: ACOE and RWQCB shall determine the total wetland areas impacted by the Project, and determine the appropriate amount of offsite compensatory mitigation credits to off-set impacts to the wetlands. The Butte County Department of Development Services shall ensure the condition is met prior to development activities.

1.5 CULTURAL RESOURCES

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
V. Cultural Resources.				
Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource pursuant to Section 15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	☐	☒	☐	☐
c) Disturb any human remains, including those interred outside of dedicated cemeteries?	☐	☒	☐	☐

Cultural resources include prehistoric and historic period archaeological sites; historical features, such as rock walls, water ditches and flumes, and cemeteries; and architectural features. Cultural resources consist of any human-made site, object (i.e., artifact), or feature that defines and illuminates our past. Often such sites are found in foothill areas, areas with high bluffs, rock outcroppings, areas overlooking deer migratory corridors, or near bodies of water. Although this area is not located within one of these areas, there is still the chance that culture resources could be located on site.

A record search for existing archeological sites and surveys on the project site, and within one mile, was conducted through the Northeast Information Center of the California Historical Resources Information System in June 2013. The search did not reveal the existence of any prehistoric or historic resources on the project site. However, two prehistoric sites and one historic site have been recorded within one mile of the project site. One prehistoric site included the presence of rock shelters with midden, flaked stone scatters, and bedrock mortars. The other prehistoric site included the informally documented presence of prehistoric human remains, together with contact-period Native American artifacts. The historic site consisted of stone foundations, possibly as part of a sheep shearing camp. The 2013 record search request did not include the expansion area of the site. A record search request for the entire project parcel was submitted to the Chico State University Northeast Information Center in April 2020. An archeological survey was conducted in August 2020. The record search and archeological field survey did not identify any cultural resources within the project area. A copy of the archeological survey report is attached.

Discussion

a) Cause a substantial adverse change in the significance of a historical resource pursuant to Section 15064.5?

No impact. The project site has been disturbed from past activities and no structures are located in the area proposed for development. No new construction or ground-disturbing activities are proposed that would result in impacts to historic resources. No features exist on the property, including objects, sites, or landscapes, that could be considered as having historic value to California Native American tribes, or eligible for listing in the California Register of Historic Resources.

b) **Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?**

Less than significant impact with mitigation incorporated. No new construction or ground-disturbing activities are proposed that may potentially uncover historic or prehistoric cultural resources. No features exist on the property, including objects, sites, or landscapes, that could be considered as having cultural value to California Native American tribes, or eligible for listing in the California Register of Historic Resources.

However, as referenced, the Konkow Maidu populations used the local region for seasonal and/or permanent settlement, as well as for the gathering of plants, roots, seeds, domestic materials, and hunting seasonal game. Historically, Euro-Americans utilized the region for farming, mining, and transportation opportunities. With past use of the project area by prehistoric and historic populations, unanticipated archaeological discoveries may be encountered during ground-disturbing activities, resulting in potentially significant impacts. Based on the sensitivity of the general area, NEIC staff recommended preparation of a site-specific Cultural Resources Report to determine whether resources occur on the site and identify appropriate mitigation measures. To avoid potential impacts to undiscovered prehistoric resources, historic resources, and human remains that may be uncovered during development activities on the project site, implementation of **Mitigation Measure CUL-1**, below, is recommended to reduce potential impacts to cultural resources to less than significant.

c) **Disturb any human remains, including those interred outside of formal cemeteries?**

Less than significant impact with mitigation incorporated. Indications are that humans have occupied Butte County for over 10,000 years and it is not always possible to predict where human remains may occur outside of formal cemeteries. Therefore, excavation and construction activities, regardless of depth, may yield human remains that may not be interred in marked, formal burials.

Under CEQA, human remains are protected under the definition of archaeological materials as being "any evidence of human activity." Additionally, *Public Resources Code section 5097.98* has specific stop-work and notification procedures to follow in the event that human remains are inadvertently discovered during project implementation.

The Butte County Conservation Element has established two policies that address the inadvertent discovery of human remains. COS-P16.3 requires human remains discovered during construction to be treated with dignity and respect and to fully comply with the federal Native American Graves Protection and Repatriation Act and other appropriate laws. COS-P16.4 requires work to stop if human remains are found during construction until the County Coroner has been contacted, and, if the human remains are determined to be of Native American origin, the North American Heritage Commission and most likely descendant have been consulted.

Implementation of the **Mitigation Measure CUL-1** would ensure that all construction activities associated with project development that inadvertently discover human remains, implement state required consultation methods to determine the disposition and historical significance of any discovered human remains. **Mitigation Measure CUL-1** would reduce this impact to less than significant.

Mitigation Measures

Mitigation Measure CUL-1

If grading activities reveal the presence of prehistoric or historic cultural resources (i.e., artifact concentrations, including arrowheads and other stone tools or chipping debris, cans glass, etc.; structural remains; or human skeletal remains) work within 50 feet of the find shall immediately cease until a qualified professional archaeologist can be consulted to evaluate the find and implement appropriate mitigation procedures. If human skeletal remains are encountered, State law requires immediate notification of the County Coroner (530.538.7404). If the County Coroner determines that the remains are in an archaeological context, the Native American Heritage Commission in Sacramento shall be notified immediately, pursuant to State Law, to arrange for Native American participation in determining the disposition of such remains. The provisions of this mitigation shall be followed during construction of all improvements, including land clearing, road construction, utility installation, and building site development.

Plan Requirements: This note shall be shown on all site development and building plans.

Timing: This measure shall be implemented during all site preparation and construction activities.

Monitoring: If potential cultural resources are discovered, the landowner shall notify the Planning Division and a professional archaeologist. The Planning Division shall coordinate with the developer and appropriate authorities to avoid damage to cultural resources and determine appropriate action. State law requires the reporting of any human remains.

1.6 ENERGY

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. Energy.				
Would the project:				
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☒	☐

Setting

The State of California requires local governments to address energy conservation and efficiency in new construction. The State Building Standard Code, including Title 24, applies to any new structures, additions to an existing structure, changes to the footprint of a structure, or changes to water and heating systems. In June 2001, amendments to Part 6, Title 24, of the State Administrative Code were enacted mandating more stringent conservation and efficiency requirements for new residential and non-residential construction. In Butte County, the Building Division of the Department of Development Services is responsible for enforcing all the provisions of Title 24. Butte County has several opportunities to promote energy conservation and reduce energy consumption, mainly through enforcing construction standards and through its own operations.

Discussion

a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

Less than significant impact. The project will consume energy during the expansion of the operational area (grading, paving, construction of new structures) as well as during project operation of the project. Construction activities for the new features and expansion of the operating area will consume energy through the operation of heavy off-road equipment, trucks, and worker traffic required for expansion. Fuel will be required by heavy equipment used for site preparation (grading, paving, building berms) as well as by trucks transporting materials for the new onsite buildings and construction worker trips. Energy use required by the expansion of the facility will be temporary and will not require a substantial amount of fuel. In addition, **Mitigation Measures AIR-1** and **AIR-2** contained in Section 1.3 (Air Quality) includes measures that would reduce fuel consumption during construction.

Operation of the project would result in long term energy consumption including the use of electricity as fuel for heavy equipment operations onsite. The project will also generate additional truck trips which would result in the consumption of fuel. State and federal regulatory requirements addressing fuel efficiency are expected to increase fuel efficiency over time as older, less-fuel efficient vehicles are retired, and therefore would reducing fuel energy consumption rates over time. In addition, standards implemented by the applicant as well as Mitigation Measures included in Section 1.8 to reduce greenhouse gas emissions associated with the project will also reduce energy use at the site (See **Mitigation Measure AIR-4** from Section 1.3 and **Mitigation Measure GHG-1** from Section 1.8). These include measures to increase energy efficiency of building and equipment onsite. The project would result in a less than significant impact related to wasteful, inefficient, or unnecessary consumption of energy resources during construction and operation with implementation of these measures.

b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency

Less than significant impact. Standards and mitigation measures proposed by the applicant in Section 1.3 (Air Quality) and Section 1.8 (Greenhouse Gas Emissions) will increase the energy efficiency of the project. New project structures will be required to meet the State Building Code, including Title 24 which mandates conservation and energy requirements for new residential and non-residential construction. The project will not conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

1.7 GEOLOGY AND SOILS

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. Geology and Soils.				
Would the project:				
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☒	☐	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial direct or indirect risks to life or property?	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☒	☐
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒

Discussion

a) **Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:**

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)

Less than significant impact. No known active faults are underlying, or adjacent to, the project site. The Cleveland Hill fault is the only active fault zone in Butte County identified in the most recent Alquist-Priolo Earthquake Fault Zoning Map. The Cleveland Hill fault is located east of Dunstone Drive and Miners Ranch Road, between North Honcut Creek and Mt. Ida Road, approximately 4± miles southeast of the City of Oroville and 2± miles northeast of the site. Because the nearest active fault is located a considerable distance from the project site, the likelihood of a surface rupture at the project site is very low, and would not be a design consideration for future development.

ii) Strong seismic ground shaking?

Less than significant impact. Ground shaking at the project site could occur due to the earthquake potential of the region's active faults. However, active faults are relatively distant from the project site and would result in low to moderate intensity ground shaking during seismic events. Future development on the project site would be subject to the California Building Code (CBC). The CBC would provide minimum standards to safeguard life or limb, health, property and public welfare by regulating the controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of buildings and structures within Butte County, in addition to providing building design criteria for earthquake conditions in Butte County. Adherence to the CBC during building construction would ensure that potential impacts are less than significant.

iii) Seismic-related ground failure, including liquefaction?

Less than significant impact. According to Butte County General Plan 2030, areas that are at risk for liquefaction can be found on the valley floor, especially near the Sacramento and Feather Rivers, and their tributaries, which have a higher potential to contain sandy and silty soils. The project site is located in the valley region of the County atop a layer of volcanic mudflow breccia. Due to the presence of the hardpan layer, no sandy or silty soils are present that would present a risk of liquefaction to the proposed project. The California Building Code (CBC) regulates the construction of structures, which may be constructed with approval of the proposed project. Adherence to CBC standards at the time of development of the resultant parcels would ensure that any impacts from an unstable geologic unit or soil are less than significant.

iv) Landslides?

Less than significant impact. A field reconnaissance did not indicate the presence of landslides features underlying, or adjacent to, the project site. However, shallow slope failures can occur in virtually any sloping terrain. Avoidance of potentially sensitive slopes and/or implementation of appropriate engineering and construction measures at the time of development would avoid or reduce potential impacts of landslides to a less than significant level.

b) Result in substantial soil erosion or the loss of topsoil?

Less than significant impact with mitigation incorporated. According to Figure HS-5 of Butte County General Plan 2030, the project site has a slight to moderate potential of soil erosion. Surface soil erosion and loss of topsoil have the potential to occur in any area of the county from disturbances associated with the construction-related activities. Construction activities could also result in soil compaction and wind erosion effects that could adversely affect soils and reduce the revegetation potential at the construction site and staging areas.

During construction-related activities, specific erosion control and surface water protection methods for each construction activity would be implemented on the project site. The type and number of measures implemented would be based upon location-specific attributes (i.e., slope, soil type, weather conditions). These control and protection measures, or BMPs, are standard in the construction industry and are commonly used to minimize soil erosion and water quality degradation.

Additionally, future construction activities may be subject to the National Pollutant Discharge Elimination System (NPDES) General Construction Activities Storm Water permit program if one acre or more of land is disturbed. Construction activities that result in a land disturbance of less than one acre, but which are part of a larger common plan of development, also require a permit. This program requires implementation of erosion control measures during and immediately after construction that are designed to avoid significant erosion during the construction period. In addition, the project operation would be subject to State Water Resources Control Board requirements for the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) to control pollution in stormwater runoff from the project site, including excessive erosion and sedimentation (**Mitigation Measure GEO-1**). The SWPPP, if required, must be obtained prior to any soil disturbance activities. Implementation of standard erosion control BMP's during future construction-related activities, together with adherence to State requirements regarding grading activities, would ensure that potential erosion impacts are less than significant.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

Less than significant impact. Destabilization of natural or constructed slopes could occur as a result of future construction activities. Excavations, grading, and fill operations associated with existing and proposed berms, existing and proposed stockpiles and windrows, stormwater conveyance structures, and roads onsite could alter existing slope profiles making them unstable as a result of over-excavation of slope material, steepening of the slope, or increased loading. Standard engineering design features and construction procedures would be implemented to maintain stable slopes and excavations during construction and operations, reducing impacts of unstable slopes to a less than significant level.

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial direct or indirect risks to life or property?

Less than significant impact. According to Figure HS-8 in the Butte County General Plan, the project site is located in an area with high potential for expansive soils. Expansive soils are those that have potential to undergo significant changes in volume, either shrinking or swelling, with changes in moisture content. Periodic shrinking and swelling of expansive soils can cause extensive damage to buildings, other structures and roads. Soils of high expansion potential generally occur in the level areas of the Sacramento Valley, including the City of Oroville and other population centers.

Appropriate design features to address expansive soils may include excavation of potentially problematic soils during construction and replacement with engineered backfill, ground-treatment processes, direction of surface water and drainage away from foundation soils, and the use of deep foundations such as piers or piles. Implementation of these standard engineering methods and adherence to California Building Code (CBC) standards at the time of development would ensure that any impacts associated with expansive soils would remain less than significant

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

Less than significant impact. Wastewater disposal on the project site is handled by an individual, onsite septic system. The applicant completed a pre-application review with Butte County Department of Environmental Health. A septic location on the project site was evaluated and determined to have adequate soil conditions to allow for the existing and proposed development during the 2014 IS/MND. The project includes installation of two additional septic systems. The future wastewater system will be constructed in conformance with Butte County Code, Chapter 19, as well as the Butte County Onsite Wastewater Manual. An On-Site Wastewater System Construction Permit must be approved by the Butte County Environmental Health Division, under a ministerial permit application. Application for a Construction Permit will include detailed plans of the proposed wastewater system, prepared by a Certified Installer or Certified Designer, which will demonstrate compliance with County regulations and the County's On-Site Wastewater Manual, and to ensure a safe, sanitary, and environmentally sound wastewater system. Compliance with Environmental Health Division conditions would reduce potential impacts to less than significant.

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

No impact. There are no known paleontological resources or unique geologic features on the project site that will be impacted by the project.

Mitigation Measures

Mitigation Measure GEO-1:

Prior to the issuance of a grading permit, the applicant shall submit a Notice of Intent (NOI) and SWPPP to the RWQCB in accordance with the NPDES General Construction Permit requirements (Order NPDES No. CAS000001/Order 2014-0059-DWQ). The SWPPP shall be designed to control pollutant discharges utilizing Best Management Practices (BMPs) and technology to reduce erosion and sediments. BMPs may consist of a wide variety of measures taken to reduce pollutants in stormwater runoff from the project site. Measures shall include temporary erosion control measures (such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover) that will be employed to control erosion from disturbed areas. Final selection of BMPs will be subject to approval by Butte County and the RWQCB. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the RWQCB.

1.8 GREENHOUSE GAS EMISSIONS

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. Greenhouse Gas Emissions.				
Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☒	☐	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☒	☐	☐

Environmental Setting

The Butte County Climate Action Plan (CAP) was adopted on February 25, 2014. The Butte County CAP provides goals, policies, and programs to reduce GHG emissions, address climate change adaptation, and improve the quality of life in the county. The Butte County CAP also supports statewide GHG emission-reduction goals identified in AB 32 and SB 375. Programs and actions in the CAP are intended to help the County sustain its natural resources, grow efficiently, ensure long-term resiliency to a changing environmental and economic climate, and improve transportation. The Butte County CAP also serves as a Qualified GHG Reduction Strategy under CEQA, simplifying development review for new projects that are consistent with the CAP.

A 2006 baseline GHG emission inventory was prepared for unincorporated Butte County. The inventory identified the sources and the amount of GHG emissions produced in the county. The leading contributors of GHG emissions in Butte County are agriculture (43%), transportation (29%), and residential energy (17%). The Climate Action Plan (CAP) adopted by the County provides a framework for the County to reduce GHG emissions while simplifying the review process for new development. Measures and actions identified in the CAP lay the groundwork to achieve the adopted General Plan goals related to climate change, including reducing GHG emissions to 1990 levels by 2020.

New projects are evaluated to determine consistency with the CAP and to identify which GHG emission reduction measures would be implemented with project approval. These measures may include the expansion of renewable energy systems for new residential development by prewiring future development for photovoltaic systems; reduction of construction equipment idling time; and, installation of electric vehicle charging outlets in the garage or the exterior of the home.

BCAQMD has not established GHG thresholds to measure the significance of GHG emissions from land use or construction projects. Sacramento Metropolitan Air Quality Management District (SMAQMD) GHG thresholds are used by Butte County to determine the significance of GHG emissions. The Sacramento Area Regional GHG Thresholds include the following project categories and emission levels:

- Stationary source projects: 10,000 direct metric tons of CO2e per year.
- Operation of a land development project: 1,100 metric tons CO2e per year.
- Construction of a project: 1,100 metric tons CO2e per year.

Discussion

a) **Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?**

Less Than Significant Impact with Mitigation Incorporated. Project operations are a direct and indirect source of greenhouse gas emission, in that they generate and attract vehicle trips (mobile source emissions) and increase area source emissions and energy consumption.

The project includes several objectives that help to off-set GHG emissions generated by ongoing operations. These objectives include supporting diversion of greenwaste from the solid waste stream sent to the Neal Road Landfill, supporting a reduction in the amount of agricultural residue burned on agricultural lands by providing agricultural operators a cost-effective means of disposing agricultural waste, and processing of agricultural waste products into building materials and biofuels.

The potential change to the IS/MND is the increase in truck trips using the site. As discussed in Section 1.3, additional onsite equipment and passenger vehicle trips generated will result in negligible emissions. The project will generate an additional 22 round trip truck trips (44 one way) employee trips each day with an average round-trip distance of 75 miles, which results in an additional 1,650 vehicle miles traveled each operating day or 514,800 additional miles each year. At 6 miles per gallon, the additional truck trips will require 85,800 gallons of fuel each year. This data was entered into the Environmental Protection Agency (EPA) Greenhouse Gas Equivalencies Calculator yielding CO2e emissions (763 metric tons per year) below applicable thresholds.

The project will generate construction related emissions during the facility expansion which could be generated from construction equipment exhaust, construction employee vehicle trips, architectural coatings, and asphalt paving. The project's construction GHG emissions would occur over a short duration and would consist of emissions from equipment exhaust.

The applicant has also implemented various building and design standards that are intended to minimize GHG emissions associated with the proposed project. These building and design standards made by the applicant were a Condition of Approval for the previous IS/MND. Listed below are the standards being implemented by the applicant as part of the project:

- Limit the maximum idling time for all construction equipment to three minutes or less.
- Achieve CALGreen Tier 1 standards for energy efficiency, water conservation, and passive design for non-residential uses.

In addition the building and design standards listed above, the BCAQMD requires standard measures that would reduce GHG emissions. **Mitigation Measure AIR-4** from Section 1.3 (Air Quality) includes the following BCAQMD standards:

- Increased building energy efficiency rating by 10 percent above what is required by Title 24 requirements. This can be accomplished in a number of ways (increasing attic, wall or floor insulation, etc.)
- Improvement of thermal efficiency of structures as appropriate by reducing thermal load with automated and timed temperature controls, or occupancy load limits.
- Incorporate shade trees, adequate in number and proportional to the project size, throughout the project site to reduce building heating and cooling requirements.
- Use fleet vehicles that run on clean-burning fuels as may be practicable.

Implementation of **Mitigation Measure GHG-1**, below, which incorporates the applicant's building and design standards, and **Mitigation Measure AIR-4**, would reduce construction and operational greenhouse gas emissions to the extent feasible.

b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Less Than Significant Impact with Mitigation Incorporated. Implementation of **Mitigation Measure GHG-1** would mitigate project-generated GHG emissions through programmatic-level measures established through the Butte County CAP. The project's compliance with the applicable policies and measures in the CAP would in turn support County-wide efforts to meet statewide GHG emission reduction goals. In addition, the project would be consistent with the following CAP policies that focus on reduction in County-wide GHG emissions.

Policy EN7. Encourage new nonresidential buildings to meet and exceed CALGreen standards for energy efficiency, water conservation, and passive design.

Consistent: Staff will encourage development of permanent structures and improved parking areas to include renewable energy elements such as solar PV to reduce electrical energy demand.

Policy EN9. Support distributed generation in new nonresidential development to reduce on-site energy use.

Consistent. Staff would support actions to incentivize renewable energy installations on new nonresidential projects. This may include streamlining the permitting process and prewiring requirements that could facilitate installation of a distributed system on-site.

Mitigation Measures

<u>Mitigation Measure GHG-1</u>

The project proponent shall implement the following measures during construction-related activities and at the time of development to offset the anticipated contribution of greenhouse gas emissions:

- Achieve CAL Green Tier 1 standards for energy efficiency, water conservation, and passive design for non-residential uses.
- Prewire new non-residential development for solar PV systems and maximize roof space to accommodate future rooftop solar installation.
- Prewire the facility for ground-mounted solar PV systems.
- Improve fuel efficiency from construction equipment by limiting idling time for all construction equipment to three minutes or less.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: Shall be implemented prior to issuance of building permits for development. Construction-related measures shall be adhered to throughout all grading and construction periods.

Monitoring: The Planning Division will ensure that future residential development includes the applicable measures during Building Permit review. Building inspectors shall spot check and shall ensure compliance on-site.

1.9 HAZARDS AND HAZARDOUS MATERIALS

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IX. Hazards and Hazardous Materials.				
Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and/or accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	☐	☐	☐	☒
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?	☐	☐	☒	☐

Setting

Under Government Code Section 65962.5, the California Department of Toxic Substances Control (DTSC) maintains a list of hazardous substance sites. This list, referred to as the "Cortese list," includes CALSITE hazardous materials sites, sites with leaking underground storage tanks, and landfills with evidence of groundwater contamination. A search of state and federal agency databases for hazardous materials sites within one-mile of the project site was performed. Based on the search, one active contamination site was identified at a property located at 766 Oroville-Chico Highway, approximately ¾ miles southeast of the project site. The contaminated site is approximately 6.79 acres, and presently used as a scrap metal recycling business. Previous environmental investigations indicate that hazardous substances including arsenic, copper, lead, zinc and PCBs were detected in the surface soil and waste piles at the site. In some cases, the concentration of these substances exceeded statutory and regulatory levels for hazardous wastes, creating a potential threat to human and environmental health. Cleanup at this site has been completed and the case is listed closed as of April 10, 2020.

Airports

Air transportation in Butte County is served by a number of private and public airfields and heliports serving general aviation and agricultural users. There are four major aviation facilities in Butte County that serve the general public. The Paradise Skypark Airport is the nearest general aviation airport to the project site. It is located approximately 7.0 miles northeast from the project site. The airport is privately owned and operated. Facilities include a 3,100-foot runway and parking spaces for approximately 50 aircraft.

Wildland Fire Conditions

The combination of highly flammable fuel, long dry summers and steep slopes creates a natural hazard of wildland fires in many areas of Butte County. Wildland fires can result in death, injury, economic losses, and a large public investment in firefighting efforts. Woodland and other natural vegetation can also be destroyed during wildfires, resulting in the loss of timber, wildlife habitat, scenic quality, and recreation. Areas in the county that are particularly susceptible to wildland fires largely contain dense vegetation and steep slopes, which aide in the spread of fire. These areas have been designated as Fire Hazard Severity Zones by the State Department of Forestry and Fire Protection (Cal Fire), and generally include the foothill and mountainous regions of Butte County.

Fire protection services for unincorporated Butte County are generally provided by the Butte County Fire Department (BCFD) and the California Department of Forestry and Fire Protection (CalFire), with CalFire having fiscal responsibility for preventing and suppressing wildfires. Due to the heightened risk of wildfires and the increased potential for damage or loss in certain areas of the county, CalFire has designated these areas as State Responsibility Areas (SRA). Development within SRAs must comply with special building requirements, and are also regulated by Public Resources Code 4290 and 4291, which establish requirements for maintenance of defensible space and vegetation management.

According to the Health and Safety Element of the Butte County General Plan, the project site is not located in a Fire Hazard Severity Zone due to the project site consisting of level slopes and grassland. The project site is also not located in the SRA area. However, because wood and composting stockpiles include the onsite storage of large quantities of combustible materials in confined areas and are maintained at elevated temperatures to facilitate decomposition, there is a risk of combustion.

Discussion

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Less than significant impact with mitigation incorporated. The project requires the use of petroleum-based products such as gasoline, diesel fuel, hydraulic fluid, solvents, oils, etc. that are used to maintain vehicles and motorized equipment during construction-related activities and project operations. These products are classified as potentially hazardous, where the accidental release of such materials could potentially cause impacts to surface and groundwater resources. All used oils would be recycled or disposed of at a proper receiving facility. Deliveries of hazardous materials would be by approved shippers under proper manifests. Hazardous materials, or fuels, could spill during transfer or fueling activities, as a result of an accident or as a result of a leaking container. To reduce the potential impacts of these impacts to a less than significant level, **Mitigation Measure HAZ-1** is recommended.

Exposure to disease and nuisance from vectors and vermin: Compost can potentially harbor vectors, such as flies, mosquitoes and fleas that can transit pathogens to human hosts. Unlike composting facilities that primarily process food waste, rodents and birds are not attracted to or associated with green materials composting operations. These compostable materials are not "food" sources for these pests. Vector control will normally be carried out as part of the operations plan, such as during the compost rotation process, and during the screening and grinding process. These activities subject compost and windrow piles to disturbances that will deter species from nesting and breeding within compost materials while reducing odors that attract vector species to compost areas.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and/or accident conditions involving the release of hazardous materials into the environment?

Less than significant impact with mitigation incorporated. Project construction activities and project operations are not expected to create a hazard to the public through accidental release of hazardous materials. The uses of materials considered hazardous are limited to fuels, oils, and solvents, which are contained within approved hazardous materials storage containers, which were constructed since the 2014 IS/MND, or within the vehicles. Any potential impacts that could occur as a result of the accidental release of materials are minimized and contained through implementation of standard best management practices and measures identified in the SWPPP.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

No impact. No existing or proposed schools have been identified within one-quarter mile of the project site. The nearest schools are Durham Elementary, Durham Intermediate, and Durham High School, which are located approximately 3.0 miles west from the project site.

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code §65962.5 and, as a result, would it create a significant hazard to the public or the environment?

No impact. A search of the EnviroStor and Geotracker databases does not show any hazardous materials sites located on the project site. The closest site is a state response cleanup site (Chico Scrap Metal) located 3/4 miles southeast of the project site. Cleanup at this site has been completed, and the case is listed closed as of April 10, 2020.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?

No impact. No public use airports or private airstrips have been identified to be located within the vicinity of the project site. The proposed project is located outside the compatibility zones for the area airports, and therefore, would not result in a safety hazard to people working and residing on the project site.

f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

No impact. The proposed project does not include any actions that physically interfere with any emergency response or emergency evacuation plans. The project would increase the amount of daily vehicle and truck trips onto the area roadways due to an increase in compost production and processing of materials; however, area roadways and intersections would continue to operate at an acceptable level of service. In the event future construction activities require work to be performed in the roadway, appropriate traffic control plans would be prepared in conjunction with a Butte County Encroachment Permit.

g) **Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?**

Less than significant impact. Composting operations will require green material to reach certain high temperatures adequate for composting and there is the possibility that fire could result in the materials being composted if appropriate care is not taken. Several fire control measures are being implemented to reduce the potential for fire at the facility to a less than significant level. These measures include:

- Construction of onsite groundwater well for fire suppression;
- Providing fire hydrants adjacent to material handling areas;
- Maintaining a minimum 20-foot separation between composting windrows;
- Construction of earthen berms along the perimeter of the project site to minimize the spread of wildfire to offsite areas;
- Maintaining a 50-foot setback between the material stockpiles and property lines;
- Temperature monitoring of composting stockpiles;
- Onsite personnel available 24 hours a day.

Mitigation Measures

Mitigation Measure HAZ-1:

Prior to construction, the applicant shall submit an updated Hazardous Materials Business Plan (HMBP) for review and approval by Butte County Environmental Health Division and Butte County Fire Department. The HMBP shall establish management practices for handling, storing, and disposal of hazardous materials, including fuels, paints, cleaners, solvents, pesticides, fertilizers, etc., during operations to reduce the potential for spills and to direct the safe handlings of these materials if encountered. The HMBP shall also identify the appropriate areas for fuel dispensing, which shall be designed with spillage catchments such that any accidental spillage is prevented from entering waterways or into the aquifer. The approved HMBP shall be maintained onsite and all personnel shall acknowledge that they have reviewed and understand the plan.

1.10 HYDROLOGY AND WATER QUALITY

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. Hydrology and Water Quality.				
Would the project:				
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?	☐	☒	☐	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i) Result in substantial on- or offsite erosion or siltation;	☐	☐	☒	☐
ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☐	☒	☐
iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	☐	☐	☒	☐
iv) Impede or redirect flood flows?	☐	☐	☒	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☐	☒
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☐	☐	☒

Setting

Surface Waters

The project site is located near Hamlin Slough, which is located approximately 180 feet southeast of the project site. Hamlin Slough is characterized as a small stream (Class IV). Further downstream along Hamlin Slough, the channel becomes highly modified, intersecting with several irrigation canals, before draining into Butte Creek. Additional onsite surface waters (vernal pools, vernal swales, and other waters) are shown on Figure 3.

Groundwater

Department of Water Resources Bulletin 118 categorizes the project site to be located in the Sacramento Valley Groundwater Basin, East Butte subbasin. The East Butte subbasin has a total surface area of 265,390 acres or 415 square miles. Groundwater quality in the East Butte subbasin is characterized as being predominately calcium-magnesium bicarbonate and magnesium-calcium bicarbonate waters with localized high concentrations of manganese, iron, magnesium, total dissolved solids, conductivity, ASAR, and calcium.

Flooding

Flooding events can result in damage to structures, injury or loss of human and animal life, exposure of waterborne diseases, and damage to infrastructure. In addition, standing floodwater can destroy agricultural crops, undermine infrastructure and structural foundations, and contaminate groundwater. The Federal Emergency Management Agency (FEMA) is responsible for mapping areas subject to flooding during a 100-year flood event (i.e., 1 percent chance of occurring in a given year). According to floodplain mapping of the proposed expansion area and current operation area, the project site is located within the X zone. The X zone is defined by FEMA as areas of minimal flood hazard from the principal source of flood in the area and determined to be outside of the 0.2 percent annual chance floodplain. According to floodplain mapping, the existing stormwater filtration field is located in the AO and A zones, placing the area within the 100-year floodplain.

Inundation Zone

Dam failure is generally a result of structural instability caused by improper design or construction, instability resulting from seismic shaking, or overtopping and erosion of the dam. Larger dams that are higher than 25 feet or with storage capacities over 50 acre-feet of water are regulated by the California Dam Safety Act, which is implemented by the California Department of Water Resources, Division of Safety of Dams (DSD). The project site is not located in an area identified as an inundation zone by the DSD.

Discussion

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

Less than significant impact with mitigation incorporated. Wastewater disposal for the proposed project is now provided by private, on- site septic system approved by the Butte County Environmental Health Division. Two additional septic systems are proposed as part of the project. Preliminary review of the project will be required by Butte County Environmental Health Division and the applicant will obtain septic permits for the proposed additional systems to ensure compliance with wastewater disposal standards.

Construction activities associated with the project have the potential to temporarily increase the sediment load of stormwater runoff from construction areas (i.e., disturbing soil at work area, the staging area, access road, etc.).

During construction-related activities, specific erosion control and surface water protection methods for each construction activity would be implemented on the project site. The type and number of measures implemented would be based upon location-specific attributes (i.e., slope, soil type, weather conditions). These control and protection measures, or BMPs, are standard in the construction industry and are commonly used to minimize soil erosion and water quality degradation. Construction activities are subject to the NPDES General Construction Activities Storm Water permit program because one acre or more of land is being disturbed. Construction activities that result in a land disturbance of less than one acre, but which are part of a larger common plan of development, also requires a permit. Adherence to **Mitigation Measure GEO-1** would ensure that no significant water quality or waste discharge impacts occur.

The facility has obtained coverage under the General Permit for Storm Water Discharges Associated with Industrial Activities (Order NPDES No. CAS000001/2014-0059-DWQ). The Permit regulates industrial stormwater discharges and authorized non stormwater discharges from industrial facilities in California. The expansion areas of the site will be added to the existing SWPPP for the site.

As previously indicated construction activity exposes soils to erosion and could result in the transportation of sediment into local drainages. Additionally, if fuel is accidentally spilled during re-fueling of heavy equipment during construction or operation of the facility water quality could be degraded. These impacts would be mitigated by implementing the BMPs that will be included in the Construction and Industrial General Permit SWPPPs, as well as the Hazardous Materials Business Plan prepared for the project

b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

Less than significant impact. Domestic water services to the project site are currently provided by a private, groundwater well. The project includes installation of a second groundwater well. A permit for the additional well will be required by Butte County Environmental Health. New development requiring a domestic water supply would increase groundwater extraction; however, it is anticipated sufficient groundwater resources are available in the project area to serve the proposed uses at the site.

The proposed project has the potential to result in a net increase in impervious surfaces on the project site from the grading of topsoil and placement of new structures. Proposed structures would result in only a minor increase in impervious surfaces from the construction of concrete foundations and access road surfacing. Thus, the proposed project would not cause a measureable reduction in surface infiltration or a decrease in deep percolation to the underlying aquifers.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

i) Result in substantial on- or offsite erosion or siltation;

Less than significant impact. Ground disturbance during construction activities associated with the build-out of the project may alter existing drainage pathways so as to make surface soils more susceptible to erosive forces (i.e., overland flow) and/or generate enough increased runoff through removal/clearing of existing vegetation to increase surface erosion. As discussed in section a.), above, implementation of erosion control measures or BMPs during construction activities would minimize soil erosion and water quality degradation.

ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;

Less than significant impact. Construction activities associated with the project will not alter drainage patterns such that they would cause on- or offsite flooding. Vegetation removal and soil disturbance occur during grading activities, resulting in the potential for increased stormwater runoff. However, construction of stormwater retention facilities, together with implementation of BMPs, minimizes the potential for surface runoff and reduces the potential for flooding. The project would result in an increase in impervious surface area from build-out of the proposed project. Some increase in stormwater runoff may be expected due to the reduced absorption rate created from new impervious surfaces on the site, such as structures, driveways, and hardscape. However, any potential impacts would be less than significant.

iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or

Less than significant impact. The project will generate an increase in runoff from the development of planned structures, access roads, and the grading of land. The current facility area has obtained coverage under the General Permit for Storm Water Discharges Associated with Industrial Activities (Order NPDES No. CAS000001/Order 2014-0059-DWQ). The intent of the order is to protect water quality by controlling pollutants in stormwater runoff and requires the development of a SWPPP which includes measures to reduce or eliminate pollution from industrial facilities during storm events. The SWPPP for the site will updated to include the expanded operations and stormwater from the expansion area will be conveyed to the existing stormwater drainage system. The project will generate runoff similar to that generated by current activities at the site and will not include substantial additional sources of polluted runoff. The project will not contribute runoff that would exceed the stormwater drainage system of the site or provide substantial additional sources of polluted runoff.

iv) Impede or redirect flood flows?

Less than significant impact. The Stormwater filtration field for the facility is located in the AO and A Flood Zones, as defined by FEMA. The AO Zone denotes a high-risk flood area with at least a 1 percent chance of flooding annually. Areas in the AO Zone typically experience sheet flows of flood waters with a depth of 1 to 3 feet. The A Zone also experiences a 1 percent chance of flooding annually; however, no Base Flood Elevations have been determined. The remaining areas of the project site, including the facility operations area, lies outside the 100-year flood hazard zone.

d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

No impact. The Stormwater Filtration field for the facility is located in the AO and A Flood Zones, as defined by the Federal Emergency Management Agency (FEMA). The AO Zone denotes a high-risk flood area with at least a 1 percent chance of flooding annually. Areas in the AO Zone typically experience sheet flows of flood waters with a depth of 1 to 3 feet. The A Zone also experiences a 1 percent chance of flooding annually; however, no Base Flood Elevations have been determined. The remaining areas of the project site, including the facility operations area, lies outside the 100-year flood hazard zone. Although located within a seismically-active region, the project site is not located in an area that would be impacted by a seiche, tsunami, or mudflows. The project does not risk release of pollutants due to project inundation.

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

No impact. The project site is located within the Vina Groundwater Subbasin of the Sacramento Valley groundwater basin. The project includes installation of an additional groundwater well at the site and will require approval from Butte County Environmental Health. The project site is located within the Butte County Groundwater Management Plan area. As referenced, the site is within the Sacramento River Valley Groundwater Basin. Provided future development is consistent with the zoning designation, the project would be part of demand projections through 2030 as summarized above. No impact would occur under this threshold.

1.11 LAND USE AND PLANNING

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. Land Use and Planning.				
Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒

Environmental Setting

Butte County General Plan

The General Plan represents the community's values, ideals and aspirations with respect to land use, development, transportation, public services, and conservation policy that will govern Butte County through 2030. The Land Use Element of the General Plan designates the land use of areas within the County and includes a description of the characteristics and intensity of each land use category. The land use designation for the proposed project site is as follows:

Agriculture

This designation allows the cultivation, harvest, storage, processing, sale, and distribution of all plant crops, especially annual food crops, as well as roadside stands for the sale of agricultural products grown or processed on the property. The agriculture designation also allows livestock grazing, animal husbandry, intense animal uses, and animal matter processing. Alternative energy facilities are allowed in the Agriculture designation, subject to permit requirements. Residential uses in the Agriculture land use designation are limited to one single-family dwelling and a second dwelling unit per legal parcel. Farm labor housing is also permitted. The minimum parcel size is between 20 to 320 acres, although existing parcels smaller than the minimum may remain as legal parcels.

Durham-Dayton-Nelson Plan

The project site is located within the Durham-Dayton-Nelson Plan Area (D2N Plan) and is subject to the policies contained therein. The D2N Plan was adopted in 1992 and is part of the Butte County General Plan 2030. It covers the unincorporated communities of Durham, Dayton and Nelson in west-central Butte County. The Plan establishes land use policies for this area and designates specific areas as an urban reserve.

Butte County Zoning Ordinance

The Zoning Ordinance implements the goals and policies of the Butte County General Plan by regulating the uses of land and structures within the County. The zoning designation of the proposed project site and the intended uses of the site are as follows:

Agriculture (AG-40)

The purpose of the AG zone is to support, protect, and maintain a viable, long-term agricultural sector in Butte County. Standard for the AG zone maintain the vitality of the agricultural sector by retaining parcels sizes necessary to sustain viable agricultural operations, protection agricultural practices and activities by minimizing land-use conflicts, and protection agricultural resources by regulating land uses and development intensities in agricultural areas. Permitted uses include crop cultivation, animal grazing, stock ponds, and agricultural processing. More intensive agricultural activities, such as animal processing, dairies, hog farms, stables, forestry and logging, and mining and oil extraction, are permitted with the approval of a Conditional Use Permit. One single-family home and one second unit is permitted on each legally-established parcel within the AG zone, and residential uses for agricultural employees are permitted as an accessory use within the AG zone. The minimum permitted parcel size in the AG zone ranges from 20 acres to 160 acres.

Discussion

a) Physically divide an established community?

No impact. The project site is located in a rural area of Butte County that is primarily used for agricultural purposes, as well as low-density rural residences. Impacts from the project would be confined to the project site, and would not result in disrupting or dividing the physical arrangement of an established community.

b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

No impact. The project site is zoned *Agriculture* by the County Zoning Ordinance. The facility is a conditionally allowed use pursuant to the County use permit. The proposed project does not include an amendment to the existing land use designation, or a change to the existing land use occurring on the project site. As such, implementation of the project has not resulted in a conflict with any applicable zoning ordinances.

1.12 MINERAL RESOURCES

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XII. Mineral Resources.				
Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☒

Discussion

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

No impact. The majority of Butte County's sand and gravel deposits occur in two regions, along the Sacramento River and within a band running from north to south down the center of the county. There are no known economically viable sources of rock materials in the immediate vicinity of the project site and no mining has occurred on the project site or surrounding area. Development of the project would not preclude future extraction of available mineral resources. Future development would use mineral resources in the construction of structures and access roads. The amount of resources used for the proposed development is anticipated to be minor and would not result in the loss of resource availability within the County. No impact would occur under this threshold.

b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

No impact. The project site is not within or near any designated locally-important mineral resource recovery site.

1.13 NOISE

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIII.Noise.				
Would the project result in:				
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards?	☐	☐	☒	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Setting

According to the Butte County General Plan 2030, noise is a concern throughout Butte County, but especially in rural areas and in the vicinity of noise-sensitive uses such as residences, schools, and churches. Noise is discussed in the Health and Safety Chapter of the Butte County General Plan 2030. Tables HS-2 and HS-3 in the County General Plan (included as Tables 1.13-1 and 1.13-2 below) outline the maximum allowable noise levels at sensitive receptor land uses.

Table 1.13-1. Maximum Allowable Noise Exposure Transportation Noise Sources

	Exterior Noise Level Standard for Outdoor Activity Areas[a]		Interior Noise Level Standard	
LAND USE	L_{dn}/CNEL, dB	L_{eq}, dBA[b]	L_{dn}/CNEL, dB	L_{eq}, dBA[b]
Residential	60[c]	-	45	-
Transient Lodging	60[c]	-	45	-
Hospitals, nursing homes	60[c]	-	45	-
Theaters, auditoriums, music halls	-	-	-	35
Churches, meeting halls	60[c]	-	-	40
Office Buildings	-	-	-	45
Schools, libraries, museums	-	70	-	45
Playgrounds, neighborhood parks	-	70	-	-

Source: Table HS-2, Butte County General Plan 2030

[a] Where the location of outdoor activity areas is unknown, the exterior noise-level standard shall be applied to the property line of the receiving land use.

[b] As determined for a typical worst-case hour during periods of use.

[c] Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB Ldn/CNEL may be allowed, provided that available exterior noise-level reduction measures have been implemented and interior noise levels are in compliance with this table.

Table 1.13-2. Maximum Allowable Noise Exposure Non-Transportation Noise Sources

	Daytime 7 am - 7 pm		Evening 7 pm - 10 pm		Night 10 pm - 7 am	
NOISE LEVEL DESCRIPTION	Urban	Non-Urban	Urban	Non-Urban	Urban	Non-Urban
Hourly Leq (dB)	55	50	50	45	45	40
Maximum Level (dB)	70	60	60	55	55	50

Source: Table HS-3, Butte County General Plan 2030

Notes:

1. "Non-Urban designations" are Agriculture, Timber Mountain, Resource Conservation, Foothill Residential and Rural Residential. All other designations are considered "urban designations" for the purposes of regulating noise exposure.
2. Each of the noise levels specified above shall be lowered by 5 dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g. caretaker dwellings).
3. The County can impose noise level standards which are up to 5 dB less than those specified above based upon determination of existing low ambient noise levels in the vicinity of the project site.
4. In urban areas, the exterior noise level standard shall be applied to the property line of the receiving property. In rural areas, the exterior noise level standard shall be applied at a point 100 feet away from the residence. The above standards shall be measured only on property containing a noise sensitive land use. This measurement standard may be amended to provide for measurement at the boundary of a recorded noise easement between all affected property owners and approved by the County.

Table 1.13.1, above, identifies the maximum allowable noise exposure to a variety of land uses from transportation sources, including from roadways, rail and airports. Table 1.13-2 identifies the maximum allowable noise exposure from non-transportation sources. In the case of transportation noise sources, exterior noise level standards for residential outdoor activity areas are 60 dB (Ldn/CNEL). However, where it is not possible to reduce noise in an outdoor activity area to 60 dB Ldn /CNEL or less using a practical application of the best-available noise-reduction measures, an exterior noise level of up to 65 dB may be allowed, provided that available exterior noise-level reduction measures have been implemented and interior noise levels are in compliance with applicable standards.

Butte County Noise Ordinance

Chapter 41A, Noise Control, of the Butte County Code of Ordinance applies to the regulation of noise. The purpose of the noise ordinance is to protect the public welfare by limiting unnecessary, excessive, and unreasonable noise. Section 41A-7 specifies the exterior noise limits that apply to land use zones within the County, which are provided in Table 1.13-2.

The Butte County Noise Ordinance provides the County with a means of assessing complaints of alleged noise violations and to address noise level violations from stationary sources. The ordinance includes a list of activities that are exempt from the provisions of the ordinance; however, some noise-generating activities associated with future residential uses would not be considered to be exempt from the Noise Ordinance. Relevant information related to the exterior and interior noise limits set out by the Butte County Noise Ordinance are included below.

Chapter 41A-9 Exemptions

The following are exempted activities identified in Chapter 41A-9 that are applicable to the proposed project:

(f) Noise sources associated with construction, repair, remodeling, demolition, paving or grading of any real property or public works project located within one thousand (1,000) feet of residential uses, provided said activities do not take place between the following hours:

- Sunset to sunrise on weekdays and non-holidays;
- Friday commencing at 6:00 p.m. through and including 8:00 a.m. on Saturday, as well as not before 8:00 a.m. on holidays;
- Saturday commencing at 6:00 p.m. through and including 10:00 a.m. on Sunday; and,
- Sunday after the hour of 6:00 p.m.

Provided, however, when an unforeseen or unavoidable condition occurs during a construction project and the nature of the project necessitates that work in process be continued until a specific phase is completed, the contractor or owner shall be allowed to continue work into the hours delineated above and to operate machinery and equipment necessary to complete the specific work in progress until that specific work can be brought to conclusion under conditions which will not jeopardize inspection acceptance or create undue financial hardships for the contractor or owner;

(g) Noise sources associated with agricultural and timber management operations in zones permitting agricultural and timber management uses;

(h) All mechanical devices, apparatus or equipment which are utilized for the protection or salvage of agricultural crops during periods of adverse weather conditions or when the use of mobile noise sources is necessary for pest control;

(i) Noise sources associated with maintenance of residential area property, provided said activities take place between 7:00 a.m. to sunset on any day except Saturday, Sunday, or a holiday, or between the hours of 9:00 a.m. and 5:00 p.m. on Saturday, Sunday, or a holiday; and, provided machinery is fitted with correctly functioning sound suppression equipment;

Environmental Setting

The project site is located in a rural valley region of the county. The nearest residences are located approximately 425 feet (898 Oroville-Chico Hwy), 1,100 feet (1195 Oroville-Chico Hwy), 1,350 feet (1269 Mesa Road), and 1,975 feet (1251 Oroville-Chico Hwy). Though the residence located at 898 Oroville-Chico Hwy is approximately 425 feet from the project site, it is situated nearest to the stormwater filtration field. The facility's operation area is situated approximately 2,580 feet north from the residence.

The primary contributors to the existing noise environment surrounding the project site include sounds emanating from residential and agricultural uses, vehicle traffic along area roadways, and from naturally occurring noise sources such as wind and rushing waters. Noise is also generated by the existing facility operations. Typical noises contributed by project operations are from heavy equipment, heavy truck traffic, generators, automobiles, power tools, and landscaping equipment.

Discussion

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards?

Less than significant impact with mitigation. The project will generate temporary noise increases from construction of the expansion area. Expansion of the facility will occur over one to three years. Permanent noise generated by the project includes expanded onsite operations and additional vehicle traffic generated by the expansion.

Construction

The project will generate temporary noise from construction to expand the facility boundary (grading, paving, building and berm construction, etc.). Construction noise associated with the project is primarily from the use of heavy equipment. Construction activities would require a variety of equipment. Noise levels generated by project construction vary depending on the particular type, number, and duration of use of the various types of construction equipment. Though noises generated by heavy equipment may generate noise levels in excess of exterior noise standards identified in the General Plan, construction activities will not occur within 1,000 feet of a sensitive receptor and will during daytime hours between 7:00 a.m. and 6:00 p.m. on weekdays and non-holidays. Temporary noise impacts will be less than significant.

Operation

Typical noises contributed by project operations are from heavy equipment, heavy truck traffic, generators, automobiles, power tools, and landscaping equipment. The project will include the use of current equipment at the site, however the equipment will be used in an expanded are of the site. The proposed expansion area is toward Highway 99 and undeveloped land to the northwest of the project site and does not locate any project operations substantially closer to sensitive receptors. The closest residence to the expansion area will be approximately 1,000 feet from expanded facility boundary. The project only includes the use of several additional pieces of equipment than what is included in UP14-0002 (an additional grinder and two additional loaders).

Reference noise levels for several of the loudest pieces of equipment that are and will be used onsite are included in Table 1.13-3. Maximum noise levels from this equipment are estimated at a distance of 1,000 feet (location of closest sensitive receptor to the project boundary). Estimated maximum noise levels were calculated using the standard noise attenuation rate of 6 dB per doubling of distance from the source.

As shown in Table 1.13-3 maximum noise levels from the equipment used onsite do not exceed Butte County maximum exterior daytime noise standards at a distance of 1,000 feet. Noise levels will be lower than these estimates since a berm will be constructed along the perimeter of the facility prior to operations and all equipment will not be used at the closest point (1,000 feet) to the closest sensitive receptor. The perimeter berm will be located between operations and any sensitive land uses resulting in a further decrease of noise levels. Typically, a 5 dB reduction in noise levels can be expected for receivers whose line of sight from a source is just blocked by the barrier. Each additional 1m of barrier height will provide about 1.5 dB of additional attenuation (FHWA Noise Barrier Design Handbook). Maximum noise levels generated by equipment onsite will be at least 5 dB less than estimates contained in Table 1.13-3.

The estimated combined noise level of these pieces of equipment operated simultaneously with the shielding provided by the exterior berm is 46.3 dB Leq at the closest residence (Estimated using the Roadway Construction Noise Model and average equipment location of 2,000 feet from the closest residence). Operational noise from onsite equipment is not anticipated to exceed Butte County daytime noise standards (50 dB Leq and 60 dB Lmax) at the closest residence. The facility operates from 7:00 a.m. to 7:00 p.m. and will not generate noise during evening or nighttime hours.

Table 1.13-3: Estimated Noise Levels from Onsite Equipment

	Reference Noise Level (Lmax) 50 feet	Estimated Noise Level (Lmax) 1,000 feet
Front End Loader	80	54
Saw	76	50
Tractor	84	58

Dump Truck	84	58
Wood Chipper[1]	81	55
Reference noise levels are obtained from FHWA Construction Noise Handbook, August 2006. [1] the reference sound level is for a Morbark 1100 Tub Grinder is provided by Oxygen Environmental Ltd., Article 12 Compliance Information, 22 Dec 2004		

The project will also generate additional traffic than what was analyzed in the IS/MND prepared for UP14-0002. The project is estimated to generate an additional 27 vehicle round trips (54 one-way trips) per day). Generally, a doubling of a noise source produces only a 3 dB increase in sound pressure level. Studies have shown this increase is barely detectable to the human ear (FHWA, 1995). Traffic noise generated by the project will not result in a doubling of traffic using the project site or area roadways and will not result in a substantial noise increase along area roadways.

Construction and operation noises may be perceptible to surrounding residences and other sensitive uses, but do not result in generation of noises in excess of noise standards established in the Butte County General Plan due to the nearest residence being located over 1,000 feet away from the project site. However, if noises occur during evening hours, when ambient noise levels are lower, noises perceptible from residences could be a potentially significant impact. The mitigation measures described below (Revised Mitigation Measure NOI-1) will reduce potential noise impacts to a less than significant level.

b) Generation of excessive groundborne vibration or groundborne noise levels?

Less than significant impact with mitigation incorporated. The use of blasting and/or pile drivers during construction activities and project operations are not included as part of the proposed project. The proposed project involves temporary sources of groundborne vibration and groundborne noise during construction and project operations from the operation of heavy equipment. Operation of heavy equipment generates localized groundborne vibration and groundborne noise that is not perceptible at residences or other sensitive uses in the immediate vicinity of the project site. Additionally, with implementation of the mitigation measures listed below, operations occur during less sensitive daytime hours (i.e., between 7:00 a.m. and 7:00 p.m.), making the impact from groundborne vibration and groundborne noise be less than significant.

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

No impact. No public use airports or private airstrips have been identified to be located within two miles of the project site. The proposed project is located outside the compatibility zones for the area airports, and therefore, would not result in noise impacts to people working or residing within the project site.

Mitigation Measures

Mitigation Measure NOI-1:

The use of heavy equipment and generators during construction activities and project operations shall be prohibited between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, between the hours of 6:00 p.m. and 8:00 a.m. on Saturdays as well as holidays , and before 10:00 a.m. and after 6:00 p.m. on Sundays. In addition, all construction and project operations activities shall utilize the best available noise control techniques (e.g. improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds, whenever feasible) to eliminate or substantially reduce noise impacts during the more-sensitive nighttime hours and on days when noises might be more disturbing.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The mitigation shall be applicable during all construction activities.

Monitoring: The developer and the Disturbance Coordinator shall be responsible for ensuring compliance with this mitigation and shall respond to all complaints of noise. Department of Development Services shall investigate all complaints of excess construction-related noise.

1.14 POPULATION AND HOUSING

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. Population and Housing.				
Would the project:				
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion

a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

Less than significant impact. The project has not resulted in the extension of infrastructure facilities that would enable new land use development. Implementation of the project has required the installation of infrastructure and utilities sized to meet the needs of only the project site, and are not able to accommodate the needs of any other planned or unplanned development.

Operations associated with the project have not resulted in any direct or indirect growth-inducing impacts to the county because workers are drawn from the local work force. Project operations will require the employment of up to 18 additional employees than were included in UP14-0002. Employees drawn to the area are readily absorbed into the region with the sufficient availability of housing and have not generated demand for new residential development. Therefore, the project has not and is not anticipated to directly or indirectly induce population growth to the area.

b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

No impact. The proposed project is a stand-alone development and does not require the removal or construction of any housing. Therefore, the proposed project would not result in the loss of existing housing or cause a significant increase in the local population that would displace existing residents, necessitating the construction of additional housing.

1.15 PUBLIC SERVICES

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XV. Public Services.				
Would the project:				
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☒	☐
Police protection?	☐	☐	☒	☐
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☒	☐

Discussion

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

Fire protection?

Less than significant impact. The project does not involve any type of use that would cause an increased demand on public services, with the potential exception of fire services, which may be required due to the increased risk of fire from the associated composting facilities. The project could potentially increase demand of fire services from a potential increase in fire-related calls to the project site. The project applicant has implemented fire minimization measures into the project design including establishing 20 foot wide separations between composting windrows, frequent monitoring of internal temperatures of compost stockpiles, a 24-hour site attendant, and providing fire hydrants throughout the project site. The fire minimization measures implemented into the project design by the project applicant, together with fire reduction measures implemented through permit conditions of approval, would reduce the demand on fire services to a less than significant level.

Police protection?

Less than significant impact. The Butte County Sheriff's Office (BCSO) provides law enforcement service to the site from the headquarters located in the City of Oroville. Implementation of the proposed project could increase service calls when development occurs. While development is not expected to cause a noticeable increase in demand for law enforcement services, it is presumed adequate resources are available in the Oroville area. The project would not require any new law enforcement facilities or the alteration of existing facilities to maintain acceptable performance objectives. Any increase in demand for services would be partially offset through project-related impact fees. A less than significant impact would occur under this threshold.

Schools?

No impact. The project would not affect demand for school facilities in the area. A development impact fee for school facilities will be assessed at the time permits for the project are issued. Impact fees would partially offset any impact to area school facilities associated with development in the districts. While school districts maintain that these fees do not fully mitigate the impacts of a project, the County is precluded from imposing additional fees or mitigation by State legislation. No impact would occur under this threshold.

Parks?

No impact. The project would not affect demand for existing local and regional park facilities. Development impact fees to off-set overall increase in demand associated with development in the area will be assessed at the time a building permit is requested. No impact would occur under this threshold.

Other public facilities?

Less than significant impact. Development of the project does not require the extension of any public infrastructure, such as roads, water, or sewer systems. The project may increase demand for County services, such as law enforcement, fire protection and road maintenance. Other services such as schools, recreation and libraries would not be affected. Butte County collects various types of development impact fees to partially offset the cost and impacts associated with new development. With payment of fees, a less than significant impact would occur under this threshold.

1.16 RECREATION

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVI. Recreation.				
Would the project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☐	☒

Setting

The project site is located in the Durham Recreation and Park District (DRPD). The DRPD covers an area of approximately 182 square miles and includes the unincorporated communities of Durham, Nelson, Butte Valley, and Dayton, as well as surrounding unincorporated rural areas. The District maintains 34 acres of developed parkland and provides a variety of recreational programming and related services including swim center, various parks, and a memorial hall to serve an estimated 2010 population of 6,566. Development impact fees for residential development are collected to address new demand for recreational facilities. The nearest recreational facilities to the project site is the Durham Community Park, which is located approximately 1.5 miles west on Durham-Dayton Highway from the intersection of Oroville-Chico Highway. The Durham Community Park is the largest facility owned and operated by the District, and includes picnic and barbeque areas, playgrounds, two basketball courts, horse arena, and recreational buildings.

Discussion

a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

No impact. Increase in the demand for recreational facilities is typically associated with substantial increases in population. As discussed in Section 1.13 - Population and Housing, the project had generated growth in the local population from the creation of new employment opportunities; however, any population growth would be minor and the existing housing supply is adequate to absorb this population growth. The project would not result in an increase in demand for recreational facilities or adversely affect Butte County park/population standards.

b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

No impact. The project does not include plans for additional recreational facilities nor will it require expansion of existing recreational facilities. Therefore, the proposed project has not resulted in any adverse physical effects on the environment from construction or expansion of recreational facilities.

1.17 TRANSPORTATION

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVII. Transportation.				
Would the project:				
a) Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?	☐	☐	☒	☐
b) Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?	☐	☐	☒	☐
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
d) Result in inadequate emergency access?	☐	☐	☐	☒

Setting

Roadway Network

Regional and local access to the project site is provided by State Highway 99 (State), Durham-Dayton Highway (County Road), and Oroville-Chico Highway (County Road). State law requires that Level of Service (LOS) be established to monitor the capacity of a roadway. Butte County has adopted a General Plan policy to design, maintain and improve street facilities to maintain LOS C or better, except in congested urban areas where this policy would require a jurisdiction to make fiscally or physically infeasible improvements.

State Highway 99

(SR99) is a primary north-south route through Butte County. SR99 from its junction with SR149 north through Chico is designated as part of the National Highway System. From the Butte/Sutter County line, SR99 is a 5 lane facility through most of Gridley. After Gridley, SR99 is a rural 2 lane conventional highway up to its junction with SR149. From SR149, the route is a 4 lane facility through Chico until just past the Eaton Road Interchange, south of Garner Road. North of Garner, SR99 is a rural 2 lane conventional highway. Latest traffic volumes for SR99 at Durham-Pentz Highway are 24,600 annual average daily traffic (AADT) southbound and 26,000 AADT northbound (Caltrans, 2013).

Durham-Dayton Highway

Durham-Dayton Highway is a major, two-lane, rural collector roadway, maintained by the Butte County Public Works Department. Rural collector roads serve travel that is primarily intra-county rather than of regional or statewide importance. Durham-Dayton Highway is used primarily as access between State Route 99 and the community of Durham. The latest traffic volume counts near the project site indicate that the average daily traffic (ADT) is 2,494 vehicles trips per day, with 18.7 percent of total trips consisting of trucks (Public Works, 2013).

Oroville-Chico Highway

Oroville-Chico Highway is classified as a rural local road, maintained by the Butte County Public Works Department. Oro-Chico Road provides travel between Durham-Dayton Highway and Midway. The most recent traffic volume counts for this roadway occurred near Midway, which indicated that average daily traffic (ADT) is 300 vehicle trips per day, with 13 percent of total trips consisting of trucks (Public Works, 2013).

Public Transit

The Butte Regional Transit (B-Line) provides fixed-route bus and paratransit services to Chico, Oroville, Gridley, Biggs, and the unincorporated county. The B-Line intercity buses connect Chico, Oroville, Paradise, Gridley and Biggs, as well as the two Tribal Rancherias and casinos. Additional services that are open to the general public include Glenn Ride, which provides transportation from Chico to Glenn County, Plumas Transit, which provides weekly service between Chico and Quincy, and Greyhound and Amtrak bus lines that provide scheduled service to the Butte County area (Butte County Circulation Element, 2010). Regional routes for the B-Line commonly utilize State Route 99. However, Durham-Dayton Highway is utilized only twice a day with a route connecting Gridley to Durham to Chico. The nearest designated bus stop to the project site is Tri Counties Bank, located in Durham (B-Line, 2013).

Bicycle and Pedestrian Transportation

Bicycle facilities include bike paths (Class I), bike lanes (Class II), and bike routes (Class III). Bike paths are paved trails that are separated from the roadway. Bike lanes are lanes on roadways that are designated for use by bicycles by striping, pavement legends, and signs. Bike routes are roadways that are designated for bicycle use with signs or pavement legends, but do not have additional width for bicycle lanes.

Pedestrian facilities include sidewalks, crosswalks, pedestrian signals, and paved shoulders adjacent to rural roads. Within the vicinity of the project site area, there are no designated pedestrian facilities, including paved shoulders of sufficient width that would be affected by the proposed project.

Oroville-Chico Highway from Midway to Durham-Dayton Highway is designated as a Class II Bike Lane. No existing bike lane facilities are located along Oroville-Chico Highway.

Airport

Air transportation in Butte County is served by a number of private and public airfields and heliports serving general aviation and agricultural users. There are four major aviation facilities in Butte County that serve the general public. The Paradise Skypark Airport is the nearest general aviation airport to the project site. It is located approximately 7.1 miles northeast from the project site. The airport is privately owned and operated. Facilities include a 3,100 foot runway and parking spaces for approximately 50 aircraft.

Rail Service

The Union Pacific Railroad line runs the entire length of the states of California, Oregon and Washington, and includes numerous other western states. The nearest railroad segment to the project site is located approximately 3.0 miles east, located along Midway.

CEQA Guidelines Section 15064.3, Subdivision (B)

CEQA Guidelines section 15064.3 describes specific considerations for evaluating a project's transportation impacts. Generally, vehicle miles traveled is the most appropriate measure of a project's transportation impacts. Vehicle miles traveled refers to the amount and distance of automobile travel attributable to a project. Other relevant considerations may include the effects of the project on transit and non-motorized travel. Except for roadway capacity transportation projects, a project's effect on automobile delay shall not constitute a significant environmental impact.

According to subdivision (b), for land use projects, vehicle miles traveled exceeding an applicable threshold of significance may indicate a significant impact. Generally, projects within one-half mile of either an existing major transit stop or a stop along and existing high quality transit corridor should be presumed to cause a less than significant transportation impact. Projects that decrease vehicle miles travelled in the project area compared to existing conditions should be presumed to have a less than significant transportation impact.

Butte County does not have an applicable threshold of significance related to vehicle miles traveled. The Governor's Office of Planning and Research *Technical Advisory on Evaluating Transportation Impacts in CEQA* (OPR 2018), includes recommendation regarding significance thresholds for VMT.

The OPR Technical Advisory contains screening thresholds for land use projects and suggests lead agencies may screen out VMT impacts using project size, maps, transit availability, and provision of affordable housing. For small land use projects, absent substantial evidence indicating that a project would generate a potentially significant level of VMT, or inconsistency with a Sustainable Communities Strategy (SCS) or general plan, projects that generate or attract fewer than 110 trips per day generally may be assumed to cause a less-than significant impact.

Discussion

a) Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?

Less than significant impact. Butte County has adopted a General Plan policy to design, maintain and improve street facilities to maintain LOS C or better, except in congested urban areas where this policy would require a jurisdiction to make fiscally or physically infeasible improvements.

Level of service impacts of the traffic generated by existing permitted uses at the site were determined to be less than significant in the Initial Study and Mitigated Negative Declaration prepared for UP14-0002 due to the fact that traffic levels along Oroville-Chico Highway occurred at low levels due to having no significant traffic generating uses along the road. The volumes generated by activities included in UP14-0002 were determined to not cause an increase in traffic on roadways or intersection that would cause traffic operations to degrade to an unacceptable level of service.

The expanded chipping and grinding operations and acceptance of softwood logs included in the project are estimated to increase the number of passenger vehicles and heavy truck trips traveling to the site each day. Estimated existing traffic volumes and proposed -traffic volumes are included in Table 1.17-1. Existing traffic volumes were estimated using volumes contained in the Initial Study /Negative Declaration for UP14-0002.

The project is estimated to generate an additional 10 one-way passenger vehicle trips (5 cars entering and leaving the site) and an additional 30 one-way heavy truck trips each day (15 additional heavy trucks entering and leaving the site) for the chipping and grinding operation. The processing of softwood at the site will generate maximum additional 12 one-way heavy truck trips each day (6 truck -loads of logs entering and leaving the site).

Table 1.17-1: Existing and Proposed Traffic

	Existing Traffic (Average Daily One-Way Trips)	Expansion Traffic (Average Daily One-Way Trips)	Estimated Increase (Average Daily One-Way Trips)
Passenger Vehicles	128	138	10
Heavy Trucks	27	71	44
Total	155	209	52

Traffic generated by the facility expansion will be equally distributed throughout the operating day. The site will be open to the public from 7:00 a.m. to 4:00 p.m. each day. The project will generate an average of one additional passenger vehicle trip per hour and five additional heavy truck trips per hours over what was analyzed in the Initial Study for UP14-0002. This additional traffic would not result in a change in the level of service or delays on area roads or intersections. The project does not cause an increase in traffic on roadways or intersections that could cause traffic operations to degrade to an unacceptable level of service.

Construction activities associated with the project have the potential to generate short-term changes to traffic volumes on the area road network. Daily vehicle trips result from the arrival and departure of construction workers. Heavy truck trips would be required for hauling equipment and materials to and from the construction site. As a result, the proposed project would not cause long-term degradation in, or create substantial impacts to, the operating conditions or level of service on any of the roadways in the project area.

Construction activities associated with the proposed project would be temporary, and in compliance with a Butte County Encroachment Permit, which would require traffic control implementation, if needed.

b) Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?

Less than significant impact. The project will generate an increase in vehicle trips compared to the current facility traffic. The project is estimated to generate an average additional 54 one-way trips each operating day (44 one way truck trips and 10 one-way passenger vehicle trips). Although the project will generate additional trips, the average trip length of the trucks using the site will be shorter than current traffic generated by the project. The project will not include acceptance of materials from the North Area Recovery Station in Sacramento reducing the average truck round trip length from approximately 200 miles to 75 miles. In addition, the number of additional trips generated by the project is below the 110 trip screening threshold for VMT impacts contained in the OPR Technical Advisory, therefore the project can be assumed to cause a less-than-significant transportation impact related to vehicle miles traveled.

c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Less than significant impact. The proposed project would not change the configuration (alignment) of area roadways, and would not introduce types of vehicles that would result in dangerous conditions on area roads.

Access within the project site is provided by 30-foot wide, all-weather roads. These roads are designed for a relatively level surface, and to accommodate heavy and light vehicles traveling at low rates of speed. Additionally, separate access roads for the general public, accessing the public g disposal area, and for the commercial truck traffic, accessing the chipping and grinding area are installed to provide appropriate routes for heavy and light vehicles. Therefore, no hazards from design features of the road, or any incompatibility issues, are anticipated.

d) Result in inadequate emergency access?

No impact. The project site would be accessed via a private driveway off Oroville-Chico Highway, a County-maintained roadway. Driveways and approach aprons (encroachments) from the project site to the road are designed and constructed to meet all applicable State and local development standards, ensuring that access is adequate to provide emergency ingress and egress, and not create any unsafe conditions.

1.18 TRIBAL CULTURAL RESOURCES

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVIII. Tribal Cultural Resources.				
Has a California Native American Tribe requested consultation in accordance with Public Resources Code section 21080.3.1(b)?	☐ Yes		☒ No	
Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?	☐	☒	☐	☐
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe?	☐	☐	☐	☒

Environmental Setting

Tribal Cultural Resources are defined as a site feature, place, cultural landscape, sacred place or object, which is of cultural value to a Tribe and is either on or eligible for the California Historic Register, a local register, or a resource that the lead agency, at its discretion, chooses to treat as such (Public Resources Code Section 21074 (a)(1)).

Butte County contains a rich diversity of archaeological, prehistoric and historical resources. The General Plan 2030 EIR observes that the "archaeological sensitivity of Butte County is generally considered high, particularly in areas near water sources or on terraces along water courses" (Butte County General Plan EIR, 2010, p. 1.5-7).

A substantial adverse change upon a historically significant resource would be one wherein the resource is demolished or materially altered so that it no longer conveys its historic or cultural significance in such a way that justifies its inclusion in the California Register of Historical Resources or such a local register (CEQA Guidelines Section 15064.5, sub. (b)(2)). Cultural resources include prehistoric and historic period archaeological sites; historical features, such as rock walls, water ditches and flumes, and cemeteries; and architectural features. Cultural resources consist of any human-made site, object (i.e., artifact), or feature that defines and illuminates our past. Often such sites are found in foothill areas, areas with high bluffs, rock outcroppings, areas overlooking deer migratory corridors, or near bodies of water.

Per Assembly Bill AB 52 (Statutes of 2014) Notification Request, Public Resources Code Section 21080.3(b), the County received two letters for notification. One was from the Torres Martinez Cahuilla Indians, located in southern California near the Salton Sea, and the other was from United Auburn Indian Community, located near the City of Auburn. It was determined through discussion with the Torres Martinez Cahuilla Indians that they do not identify lands within Butte

County within their geographic area of traditional and cultural affiliation. The United Auburn Indian Community provided a map of their area of traditional and cultural affiliation, which did not include the project site.

Discussion

Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?

Less than significant impact with mitigation incorporated. Native American populations used the local region for seasonal and/or permanent settlement, as well as for the gathering of plants, roots, seeds, and seasonal game. Historically, Euro-Americans utilized the region for mining farming, and cattle ranching. With historic use of the project area by prehistoric and historic populations, unanticipated and accidental archaeological discoveries may be encountered during ground-disturbing activities, resulting in potentially significant impacts. Implementation of **Mitigation Measure CUL-1**, discussed in Section 1.5 – Cultural Resources, would avoid potential impacts to undiscovered prehistoric resources, historic resources, and human remains that may be uncovered during development activities. With implementation of **Mitigation Measure CUL-1** if needed, impacts under this threshold would be less than significant.

b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe?

No impact. As detailed in response to Checklist Question 1.5a, a records search of documented culturally-significant sites and onsite cultural resources survey was performed for the project site. Based on the information obtained through this research, no existing archaeological resources are located on the site. No impact is anticipated under this threshold.

1.19 UTILITIES AND SERVICE SYSTEMS

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIX. Utilities and Service Systems.				
Would the project:				
a) Require or result in the relocation or construction of construction of new or expanded water, wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunication facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☐	☒
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?	☐	☐	☒	☐
c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?	☐	☐	☒	☐
d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☒	☐
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☐	☒

Environmental Setting

Solid Waste

Most municipal wastes are hauled to the Neal Road Recycling and Waste Facility, which is owned by Butte County and managed by the Butte County Department of Public Works. The Neal Road Facility is located at 1023 Neal Road, one mile east from State Highway 99, and seven miles southeast of Chico, on 190 acres owned by Butte County. The Neal Road Facility is permitted to accept municipal solid waste, inert industrial waste, demolition materials, special wastes containing nonfriable asbestos, and septage. Hazardous wastes, including friable asbestos, are not accepted at the Neal Road Facility or any other Butte County disposal facility, and must be transported to a Class I landfill permitted to receive untreated hazardous waste. The Facility has a design capacity of 25,271,900 cubic yards, and is permitted to accept 1,500 tons per day; however, the average daily disposal into the landfill is approximately 466 tons. As of November 2017, the remaining capacity of the Neal Road Facility is approximately 15,449,172 cubic yards, which would give the landfill a service life to the year 2048 (Neal Road Recycling & Waste Facility, 2017).

Discussion

a) **Require or result in the relocation or construction of construction of new or expanded water, wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunication facilities, the construction or relocation of which could cause significant environmental effects?**

No impact. The project site is currently served by electric power (PG&E) and wireless phone service. Wastewater disposal for the proposed project is provided by private, onsite septic systems. The project includes an onsite 1,500-gallon septic system for wastewater disposal needs. The septic system/dispersal bed replacement field is located on the southwest corner of the project site. The project includes installation of two additional 1,500-gallon septic systems. The applicant will obtain an onsite sewage disposal permit, and commence construction in compliance with wastewater disposal standards. The project would not result in the relocation or construction of new or expanded infrastructure including water services, wastewater treatment, stormwater drainage, natural gas, or telecommunication facilities.

b) **Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?**

Less than significant impact. Domestic water to existing and planned uses on the project site is provided by a groundwater well. The new well would be installed in accordance with Butte County regulations. Existing groundwater supplies are anticipated to be available to serve the proposed project, and no additional or expanded entitlements are required for groundwater extraction and use.

c) **Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?**

Less than significant impact. The existing facility obtained coverage under the Order 2014-0057-DWQ General Permit for Stormwater Discharges Associated with Industrial Activities (IGP). Stormwater improvements at the existing facility were completed in 2019 Stormwater from the expansion area will be conveyed to the retention pond and pump station located in the southwest corner of the current facility and pumped through a series of rice checks for biofiltration prior to discharge to Hamlin Slough. The project will require the construction of stormwater drainage features in the expanded portion of the site (ditches, culverts) to convey stormwater to the retention pond of the current facility. These will be constructed in the expansion footprint of the site which is analyzed in this document. Installation of future stormwater drainage facilities would not cause significant adverse effects on the environment.

d) **Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?**

Less than significant impact. Operations would result in a minor increase of solid waste that would require disposal at the Neal Road Recycling and Waste Facility. Solid waste would be removed from the property every seven days, or as needed. The Neal Road Facility has a maximum permitted throughput of 1,500 tons per day, and an estimated current daily average throughput of 466 tons per day. Therefore, the facility would have adequate capacity to accommodate solid waste generated by the project.

e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?

No impact. The proposed project would comply with statutes and regulations related to solid waste. Waste generated by the proposed project would consist only of domestic refuse, which would be collected in approved trash bins and removed from the project site by a waste hauler or by the onsite applicant.

1.20 WILDFIRE

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XX. Wildfire.				
Is the project located in or near state responsibility areas or lands classified as high fire hazard severity zones?	☐ Yes		☒ No	
If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:				
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☐
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☐	☐
c) Require the installation of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☐	☐
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☐	☐

Environmental Setting

The land across Highway 99 from the project site is a State Responsibility Area recognized by the Board of Forestry and Fire Protection as areas where Cal Fire is the primary emergency response agency responsible for fire suppression and prevention. The land across the highway is classified as moderate hazard severity zone (CAL FIRE, 2007). The project site is located in a Local Responsibility Area in an area classified a Non-Very High Fire Hazard Severity Zone (Butte County CAL FIRE Very High Fire Hazard Severity Zones in LRA as Recommended by CAL FIRE 5/2008)

Fire control measures that are implemented to reduce fire at the facility are included under Section 1.15 Public Services and Section 1.9 Hazards and Hazardous Materials.

1.21 MANDATORY FINDINGS OF SIGNIFICANCE

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XX. Mandatory Findings of Significance.				
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

Discussion

a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?

Less than significant impact with mitigation incorporated. Potential impacts to biological resources and cultural resources associated with future project development were analyzed in this Initial Study. All direct, indirect, and cumulative impacts were determined to have no impact, a less than significant impact, or reduced to a less than significant impact with implementation of mitigation. No special status species or their habitat was identified on the site. Development of the project would not cause fish or wildlife populations to drop below self-sustaining levels or restrict the movement/distribution of a rare or endangered species. Mitigation Measures BIO-1 through BIO-3 would be implemented if needed to address potential impacts to on-site resources and nesting birds during construction.

Development would not affect known significant historic resources or known archaeological or paleontological resources. There are no known unique ethnic or cultural values associated with the project site, nor are known religious or sacred uses associated with the project site. Mitigation Measure CUL-1 has been identified to address the potential discovery of unknown resources during excavation or other soil disturbance associated with development. Additionally, the project applicant is required to comply with *California Code of Regulations (CCR) Section 15064.5(e)*, *California Health and Safety Code Section 7050.5*, and *Public Resources Code (PRC) Section 5097.98* as a matter of policy in the event human remains are encountered at any time. Implementation of **Mitigation Measure CUL-1**, as well as regulations governing human remains, would reduce potential impacts to cultural and paleontological resources to less than significant.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

Less than significant impact with mitigation incorporated. The project would have no impact, a less than significant impact or a less than significant impact with mitigation incorporated with respect to all environmental issues pursuant to CEQA. Due to the limited scope of direct physical impacts to the environment associated with the project, potential impacts are project-specific in nature.

The proposed project site is located within an area that has been designated by the County for RR-5 uses. Short-term construction-related air quality impacts that would result from construction and operation of the site improvements. Impacts would be reduced to less than significant levels with implementation of **Mitigation Measure AIR-1** through **AIR-5**. **Mitigation Measure GHG-1** would reduce potential impacts from the generation of greenhouse gas emissions to less than significant. Implementation of **Mitigation Measure NOI-1** would avoid temporary construction noise impacts at neighboring sensitive receivers to the east and west. Potential impacts associated with lighting would be addressed with implementation of **Mitigation Measure AES-1** if needed.

The cumulative effects resulting from build out of the Butte County General Plan 2030 were previously identified in the General Plan EIR. The type, scale, and location of the type of development proposed would be consistent with the County's General Plan and zoning designation with approval of a MUP and is compatible with the pattern of development on adjacent properties. Because of this consistency, the potential cumulative environmental effects of the proposed project would fall within the impacts identified in the County's General Plan EIR. The project would be subject to required "fair share" development impact fees, which will be paid at the time of development.

c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

Less than significant impact with mitigation incorporated. There have been no impacts discovered through the review of this application demonstrating that approval of the application and future project development would cause substantial adverse effects to human beings either directly or indirectly. However, the proposed development has the potential to cause both temporary and future impacts related to aesthetics, air quality, biological resources, cultural resources, greenhouse gas emissions and noise. With implementation of mitigation measures included in this Initial Study, these impacts would be mitigated to less than significant.

Authority for the Environmental Checklist: Public Resources Code Sections 21083, 21083.5.

Reference: Government Code Sections 65088.4.
Public Resources Code Sections 21080, 21083.5, 21095; *Eureka Citizens for Responsible Govt. v. City of Eureka* (2007) 147 Cal.App.4th 357; *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th at 1109; *San Franciscans Upholding the Downtown Plan v. City and County of San Francisco* (2002) 102 Cal.App.4th 656.

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Mitigation Measures and Monitoring Requirements

Old Durham Wood, Inc Conditional Use Permit (UP18-0002)

Mitigation Measure AES-1

All *lighting*, exterior and interior, shall be designed and located so as to confine direct *lighting* to the premises. A light source shall not shine upon or illuminate directly on any surface other than the area required to be lighted. No *lighting* shall be of the type or in a location such that it constitutes a hazard to vehicular traffic, either on private property or the abutting highway or street.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. The Development Services Department shall investigate and respond to any complaints of excess glare or light originating from the project site.

Mitigation Measure AIR-1

The following best practice measures to reduce impacts to air quality shall be incorporated by the project applicant, subject property owners, or third-party contractors during construction activities on the project site. These measures are intended to reduce criteria air pollutants that may originate from the site during the course of land clearing and other construction operations.

Diesel PM Exhaust from Construction Equipment and Commercial On-Road Vehicles Greater than 10,000 Pounds

- All on- and off-road equipment shall not idle for more than five minutes. Signs shall be posted in the designated queuing areas and/or job sites to remind drivers and operators of the five-minute idling limit.
- Idling, staging and queuing of diesel equipment within 1,000 feet of sensitive receptors is prohibited.
- All construction equipment shall be maintained in proper tune according to the manufacturer's specifications. Equipment must be checked by a certified mechanic and determined to be running in proper condition before the start of work.
- Install diesel particulate filters or implement other CARB-verified diesel emission control strategies.
- Shall not operate a diesel-fueled auxiliary power system (APS) to power a heater, air conditioner, or any ancillary equipment on that vehicle during sleeping or resting in a sleeper berth for greater than 5 minutes at any location when within 100 feet of a restricted areas.
- To the extent feasible, truck trips shall be scheduled during non-peak hours to reduce perk hour emissions.

Operational TAC Emissions

- All mobile and stationary Toxic Air Contaminants (TACs) sources shall comply with applicable Airborne Toxic Control Measures (ATCMs) promulgated by the CARB throughout the life of the project (see https://ww2.arb.ca.gov/resources/documents/airborne-toxic-control-measures).
- Stationary sources shall comply with applicable District rules and regulations.

Fugitive Dust

Construction activities can generate fugitive dust that can be a nuisance to local residents and businesses near a construction site. Dust complaints could result in a violation of the District's "Nuisance" and "Fugitive Dust" Rules 200 and 205, respectively. The following is a list of measures that may be required throughout the duration of the construction activities:

- Reduce the amount of the disturbed area where possible.
- Use of water trucks or sprinkler systems in sufficient quantities to prevent airborne dust from leaving the site. An adequate water supply source must be identified. Increased watering frequency would be required whenever wind speeds exceed 15 mph. Reclaimed (non-potable) water should be used whenever possible.
- All dirt stockpile areas should be sprayed daily as needed, covered, or a District approved alternative method will be used.
- Permanent dust control measures identified in the approved project revegetation and landscape plans should be implemented as soon as possible following completion of any soil disturbing activities.
- Exposed ground areas that will be reworked at dates greater than one month after initial grading should be sown with a fast-germinating non-invasive grass seed and watered until vegetation is established.
- All disturbed soil areas not subject to re-vegetation should be stabilized using approved chemical soil binders, jute netting, or other methods approved in advance by the Butte County Air Quality Management District.
- All roadways, driveways, sidewalks, etc. to be paved should be completed as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used.
- Vehicle speed for all construction vehicles shall not exceed 15 mph on any unpaved surface at the construction site.
- All trucks hauling dirt, sand, soil, or other loose materials are to be covered or should maintain at least two feet of freeboard (minimum vertical distance between top of load and top of trailer) in accordance with local regulations.
- Install wheel washers where vehicles enter and exit unpaved roads onto streets, or wash off trucks and equipment leaving the site.
- Sweep streets at the end of each day if visible soil material is carried onto adjacent paved roads. Water sweepers with reclaimed water should be used where feasible.
- Post a sign in prominent location visible to the public with the telephone numbers of the contractor and the Butte County Air Quality Management District - (530) 332-9400 for any questions or concerns about dust from the project.

All fugitive dust mitigation measures required should be shown on grading and building plans. In addition, the contractor or builder should designate a person or persons to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust offsite. Their duties shall include holidays and weekend period when work may not be in progress. The name and telephone number of such persons shall be provided to the District prior to land use clearance for map recordation and finished grading of the area.

Please note that violations of District Regulations are enforceable under the provisions of California Health and Safety Code Section 42400, which provides for civil or criminal penalties of up to $25,000 per violation.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-2

The applicant shall implement the following mitigation measures to mitigate combustion emissions from heavy-duty construction equipment.

- Maintain all off-road equipment in proper tune and regularly serviced according to manufacturer's specification.
- Meet, or exceed to the extent feasible, State On-Road and Off-Road emission standards for heavy-duty engines.
- Electrify equipment where feasible.
- Substitute gasoline-powered in place of diesel-powered equipment, where feasible.
- Use alternative fueled construction equipment on site where feasible, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane, or biodiesel.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-3

The applicant shall follow sound composting management practices, including maintaining moisture, temperature and pH levels, and proper aerating, turning and mixing the composting materials. Specifically, the following practices will help minimize the generation and dispersal of dust and fungus spores during composting operations and thus limit exposure:

- Refrain from turning, screening, or loading activities on windy days;
- Use water spray or mists during grading, screening, and pile turning activities;
- Maintain proper moisture levels in active composting piles;
- Maintain good housekeeping practices, including site cleanliness;
- Provide employee training and the use of personal protective equipment.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-4

The applicant shall implement the following standard measures as outlined in the *BCAQMD CEQA Air Quality Handbook Guidelines*:

- Increase building energy efficiency rating by 10 percent above what is required by Title 24 requirements. This can be accomplished in a number of ways (increasing attic, wall or floor insulation, etc.)
- Improvement of thermal efficiency of structures as appropriate by reducing thermal load with automated and timed temperature controls, or occupancy load limits.
- Incorporate shade trees, adequate in number and proportional to the project size, throughout the project site to reduce building heating and cooling requirements.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Building inspectors shall spot check development plans and shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

Mitigation Measure AIR-5

The applicant shall adhere to the odor management practices in the approved Odor Impact Minimization Plan, formulated in accordance with State composting regulations (Title 14 CCR §17863.4.). This plan will be submitted to the Local Enforcement Agency (LEA) as part of the application for a Solid Waste Facilities Permit (SWFP) for the facility's operations and implemented upon issuance of the SWFP. In accordance with the above-cited regulations, the plan shall contain, at a minimum:

- An odor monitoring protocol which describes the proximity of possible odor receptors and a method for assessing odor impacts at the location of possible odor receptors.
- A description of meteorological conditions effecting migration of odors and/or transport of odor-causing material offsite. Seasonal variations that effect wind velocity and direction shall also be described.
- A compliant response protocol that includes the verification and documentation upon receipt of any odor complaints and immediate notification of County LEA staff upon receipt of any odor complaints upon receipt of the call.
- A description of design considerations and/or projected ranges of optimal operation to be employed in minimizing odor, including method and degree of aeration, moisture content of materials, feedstock characteristics, airborne emission production, process water distribution, pad and site drainage and permeability, equipment reliability, personnel training, weather event impacts, utility service interruptions, and site specific concerns.
- A description of operating procedures for minimizing odor, including aeration moisture management, feedstock quality, drainage controls, pad maintenance, wastewater pond controls,

storage practices (e.g., storage time and pile geometry), contingency plans (i.e. equipment, water, power, and personnel), biofiltration, and tarping.

- The odor impact minimization plan shall be revised to reflect any changes to operating or program conditions, and a copy shall be provided to the LEA within 30 days of those changes.
- The odor impact minimization plan shall be reviewed annually by the operator to determine if any revisions are necessary.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The provisions of this mitigation measure shall be complied with at all times.

Monitoring: Butte County Environmental Health shall ensure compliance on-site. Butte County Air Pollution Control District inspectors shall respond to nuisance complaints.

<u>Mitigation Measure BIO-1</u>

Prior to grading activities, the applicant shall retain a qualified biologist to conduct protocol-level surveys during the appropriate flowering window for Red Bluff dwarf rush (March – June), Ahart's paronychia (February – June), Butte County golden clover (March – May), and Butte County meadowfoam (March – May). Surveys shall be in compliance with survey protocols for plants species listed under the California Endangered Species Act and Federal Endangered Species Act. A report summarizing the findings of surveys will be prepared and submitted to the County and the California Department of Fish and Wildlife. In the event sensitive species are identified on the project site, the biologist shall consult with the California Department of Fish and Game, and the United States Fish and Wildlife Service, to determine appropriate measures to reduce the impact of identified species to a less than significant level.

Plan Requirements: Perform protocol-level surveys for plants stated above.

Timing: Requirements of the condition shall be adhered to prior to and during construction activities planned to occur during (between March and May).

Monitoring: The Butte County Department of Development Services shall ensure the condition is met at the time of construction activities.

<u>Mitigation Measure BIO-2</u>

If project construction activities, including ground disturbance or vegetation removal occur during the nesting season for birds protected under the Migratory Bird Treaty Act (MBTA) and California Department Fish & Game Code (CDFC) (approximately February 1 – August 31), the project proponent shall retain a qualified biologist to perform preconstruction surveys for nesting bird species. Surveys to identify active bird nests shall be conducted within and 250 feet around the footprint of proposed construction site. The survey shall be conducted within 7 days prior to the initiation of construction activities. In the event that an active nest is observed, a species protection buffer shall be established. The species protection buffer will be defined by the qualified biologist based on the species, nest type and tolerance to disturbance. Construction activity shall be prohibited within the buffer zones until the young have fledged or the nest fails. Nests shall be monitored by a qualified biologist once per week and a report submitted to the Butte County Department of Development Services.

Plan Requirements: Perform protocol-level surveys for migratory birds protected by the California Department Fish & Game Code and the Migratory Bird Treaty Act.

Timing: Requirements of the condition shall be adhered to prior to and during construction activities planned to occur during nesting seasons for CDFC and MBTA species (between February 1 and August 31).

Monitoring: The Butte County Department of Development Services shall ensure the condition is met at the time of construction activities.

Mitigation Measure BIO-3

The project will result in adverse impacts to Jurisdictional Waters of the United States (U.S.) or Waters of the State. Prior to future development activities associated with the Project, the project proponent shall obtain the appropriate permits from the United States Army Corp of Engineers (ACOE) and California Regional Water Quality Control Board (RWQCB) for delineated wetland areas disturbed by past and future grading activities. Mitigation of impacted wetlands shall include the purchase of compensatory mitigation credits in order to achieve zero net loss of vernal swale/vernal pool habitat. ACOE and RWQCB will determine jurisdiction and mitigation ratios. All mitigation will be completed using off-site mitigation through the purchase of credits at a mitigation bank approved by the agency.

Plan Requirements: The United States Army Corp of Engineers (ACOE) and California Regional Water Quality Control Board (RWQCB) shall verify impacted wetland areas. Upon verification, applicable permits and other regulatory requirements shall be obtained by the project proponent. Affected agencies shall determine the appropriate ratio of offsite compensatory mitigation credits to purchase for impacted wetlands.

Timing: Requirements of the condition shall be satisfied prior to any development activity associated with the Project.

Monitoring: ACOE and RWQCB shall determine the total wetland areas impacted by the Project, and determine the appropriate amount of offsite compensatory mitigation credits to off-set impacts to the wetlands. The Butte County Department of Development Services shall ensure the condition is met prior to development activities.

Mitigation Measure CUL-1

If grading activities reveal the presence of prehistoric or historic cultural resources (i.e., artifact concentrations, including arrowheads and other stone tools or chipping debris, cans glass, etc.; structural remains; or human skeletal remains) work within 50 feet of the find shall immediately cease until a qualified professional archaeologist can be consulted to evaluate the find and implement appropriate mitigation procedures. If human skeletal remains are encountered, State law requires immediate notification of the County Coroner (530.538.7404). If the County Coroner determines that the remains are in an archaeological context, the Native American Heritage Commission in Sacramento shall be notified immediately, pursuant to State Law, to arrange for Native American participation in determining the disposition of such remains. The provisions of this mitigation shall be followed during construction of all improvements, including land clearing, road construction, utility installation, and building site development.

Plan Requirements: This note shall be shown on all site development and building plans.

Timing: This measure shall be implemented during all site preparation and construction activities.

Monitoring: If potential cultural resources are discovered, the landowner shall notify the Planning Division and a professional archaeologist. The Planning Division shall coordinate with the developer and appropriate authorities to avoid damage to cultural resources and determine appropriate action. State law requires the reporting of any human remains.

Mitigation Measure GEO-1

Prior to the issuance of a grading permit, the applicant shall submit a Notice of Intent (NOI) and SWPPP to the RWQCB in accordance with the NPDES General Construction Permit requirements (Order NPDES No. CAS000001/Order 2014-0059-DWQ). The SWPPP shall be designed to control pollutant discharges utilizing Best Management Practices (BMPs) and technology to reduce erosion and sediments. BMPs may consist of a wide variety of measures taken to reduce pollutants in stormwater runoff from the project site. Measures shall include temporary erosion control measures (such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover) that will be employed to control erosion from disturbed areas. Final selection of BMPs will be subject to approval by Butte County and the RWQCB. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the RWQCB.

Mitigation Measure GHG-1

The project proponent shall implement the following measures during construction-related activities and at the time of development to offset the anticipated contribution of greenhouse gas emissions:

- Achieve CAL Green Tier 1 standards for energy efficiency, water conservation, and passive design for non-residential uses.
- Prewire new non-residential development for solar PV systems and maximize roof space to accommodate future rooftop solar installation.
- Prewire the facility for ground-mounted solar PV systems.
- Improve fuel efficiency from construction equipment by limiting idling time for all construction equipment to three minutes or less.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: Shall be implemented prior to issuance of building permits for development. Construction-related measures shall be adhered to throughout all grading and construction periods.

Monitoring: The Planning Division will ensure that future residential development includes the applicable measures during Building Permit review. Building inspectors shall spot check and shall ensure compliance on-site.

Mitigation Measure HAZ-1

Prior to construction, the applicant shall submit a Hazardous Materials Business Plan (HMBP) for review and approval by Butte County Environmental Health Division and Butte County Fire Department. The HMBP shall establish management practices for handling, storing, and disposal of hazardous materials, including fuels, paints, cleaners, solvents, pesticides, fertilizers, etc., during operations to reduce the potential for spills and to direct the safe handlings of these materials if encountered. The HMBP shall also identify the appropriate areas for fuel dispensing, which shall be designed with spillage catchments such that any accidental spillage is prevented from entering waterways or into the aquifer. The approved HMBP shall be maintained onsite and all personnel shall acknowledge that they have reviewed and understand the plan.

Mitigation Measure NOI-1

The use of heavy equipment and generators during construction activities and project operations shall be prohibited between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, between the hours of 6:00 p.m. and 8:00 a.m. on Saturdays as well as holidays , and before 10:00 a.m. and after 6:00 p.m. on Sundays. In addition, all construction and project operations activities shall utilize the best available noise control techniques (e.g. improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds, whenever feasible) to eliminate or substantially reduce noise impacts during the more-sensitive nighttime hours and on days when noises might be more disturbing.

Plan Requirements: This note shall also be placed on all building and site development plans.

Timing: The mitigation shall be applicable during all construction activities.

Monitoring: The developer and the Disturbance Coordinator shall be responsible for ensuring compliance with this mitigation and shall respond to all complaints of noise. Department of Development Services shall investigate all complaints of excess construction-related noise.

Project Sponsor(s) Incorporation of Mitigation into Proposed Project

I/We have reviewed the Initial Study for the Old Durham Wood, Inc. Conditional Use Permit (UP18-0002) application and particularly the mitigation measures identified herein. I/We hereby modify the applications on file with the Butte County Planning Department to include and incorporate all mitigations set forth in this Initial Study.

Randy McLaughlin — 1-6-2021

Project Sponsor/Project Agent — Date

[signature] — 1-6-2021

Project Sponsor/Project Agent — Date

Nameof Property Owner	Randy McLaughlin, Old Durham Wood Company
Location of Property	APN 040-120-036; 1156 Oro-Chico Hwy, Durham, CA
Name of Preparer	VESTRA Resources, Inc.
Date Prepared	April 7, 2020
General Plan Zoning	AG40
Property Size	287.34 acres

Proposed Septic | Stormwater Pipeline | Proposed Outside Border Berm | Detention Pond

Proposed Fire Hydrant | Fire System Water Pipes | Proposed Outside Grazing Berm | Buildings

Proposed Well | Proposed Fire Water System Pipes | Proposed Building | Approximate Parcel Boundary

P Parking | Berm | Proposed Access Road

Date Prepared: September 21, 2020
Prepared by J. Williams, VESTRA Resources, Inc.

VESTRA

SOURCE: MAXAR FEBRUARY 11, 2019, AERIAL PHOTOGRAPH

0 175 350 700 Feet

1 inch = 350 feet

N

FIGURE 2
PROPOSED SITE PLAN
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

P:\GIS\71730\Figures\2020 Expansion\Use Permit\71730_ProposedSitePlan.mxd

ATTACHMENT A

gallaway ENTERPRISES

DRAFT DELINEATION OF JURISDICTIONAL WATERS OF THE UNITED STATES

Old Durham Wood Expansion Parcels

Butte County, California

February 2017

Prepared for:
Old Durham Wood
Attn: Randy McLaughlin
8616 Dumel Drive
Durham, CA 95938

Prepared by:

Gallaway Enterprises

117 Meyers Street, Suite 120
Chico CA 95928
(530) 332-9909
www.gallawayenterprises.com

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DRAFT DELINEATION OF JURISDICTIONAL WATERS OF THE UNITED STATES,

Old Durham Wood Expansion Parcels, Butte County, California

Introduction and Project Location

Gallaway Enterprises conducted a delineation of Waters of the U.S. and aquatic resources for the Old Durham Wood Expansion Parcels (Property) consisting of an approximately 179-acre site located between Oroville (Oro)-Chico Highway and State Route 99, just south of Chico in Butte County, CA (**Figure 1 and 2**). The Property is located within the Hamlin Canyon USGS Quadrangle within Sections 21, 22 and 27, Township 21N, Range 2E.

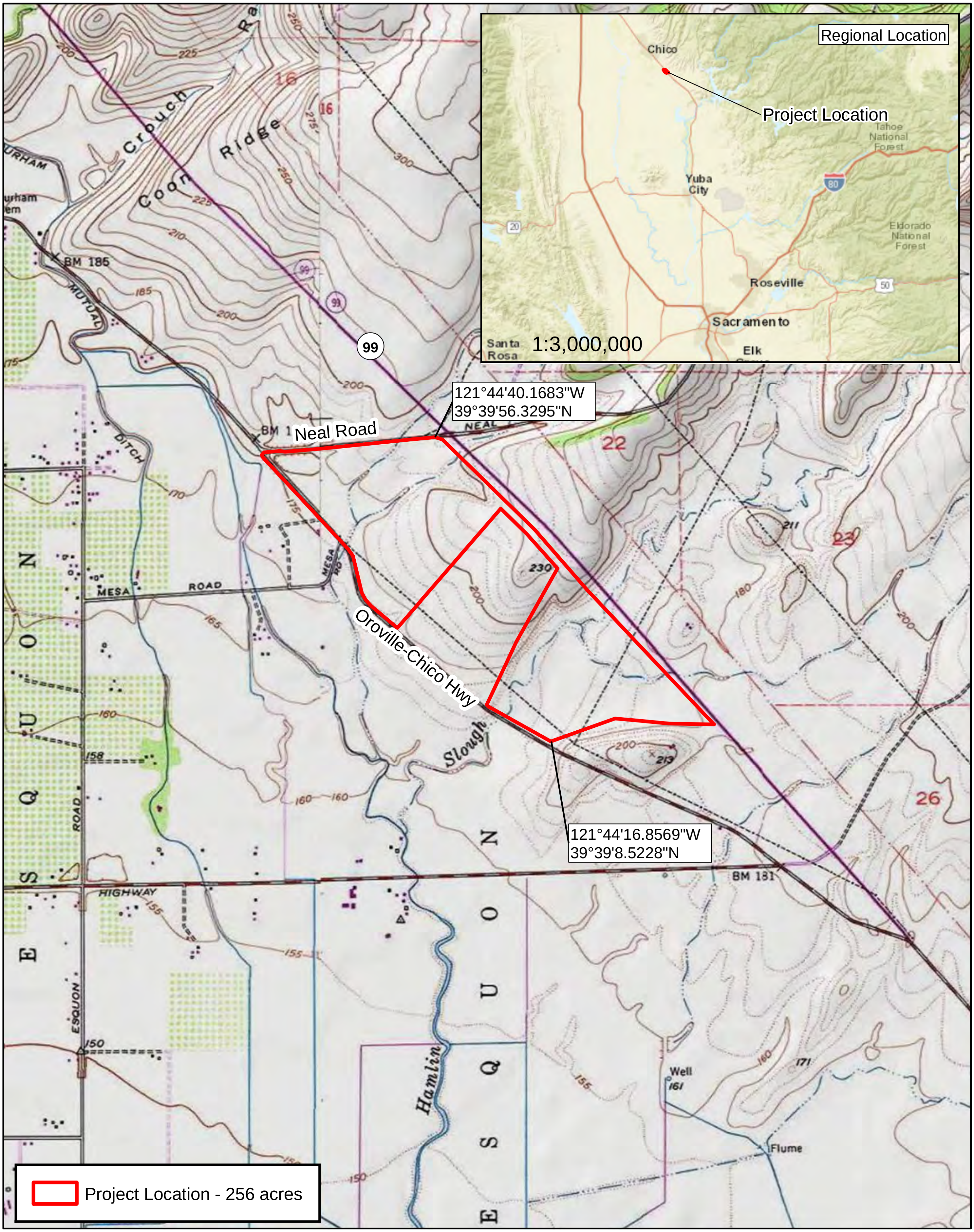
The Property is accessible via Oro-Chico Highway Butte County, CA. To access the site, take Interstate 5 N/State Highway 99 N toward Redding/Yuba City and continue on CA-99 N toward Yuba City/Marysville. Take CA-70 N past Oroville and they take CA-149 to Chico/Durham. Merge onto State Highway 99 N toward Chico. Turn left onto Neal Road. The Property occurs on the south side of Neal Road. To access the site, continue on Neal Road until it intersects with Oro-Chico Highway and turn left onto Oro-Chico Highway. Continue on Oro-Chico Highway for approximately 0.47 miles and turn left onto a dirt access road.

A wetland survey was conducted on December 21, 2016 and January 5 and 17, 2017 by Senior Botanist Elena Gregg and Biologist Melissa Murphy. Data regarding the location and extent of wetlands and other waters of the U.S. were collected using a Trimble Geo Explorer 6000 Series GPS Receiver. The survey involved an examination of botanical resources, soils, hydrological features, and determination of wetland characteristics based on the *United States Army Corps of Engineers Wetlands Delineation Manual* (1987); the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (2008); the *U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook* (2007); the *Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States*, (2008) and the *State of California 2016 Wetland Plant List.* Gallaway Enterprises have prepared this report in compliance with the Minimum Standards for Acceptance of Aquatic Resources Delineation Reports (January 2016).

Environmental Setting and Site Conditions

The Property is currently used for cattle grazing during the winter and spring months. The site has not been man-altered with the exception of the presence of a few dirt access roads and an old debris pile. The Property is composed of annual grassland habitat with lava cap occurring on the terraces and higher ridgetops within the Property, which has resulted in the presence of thin soils in mound-swale topography. Multiple drainages and wetlands occur throughout the Property.

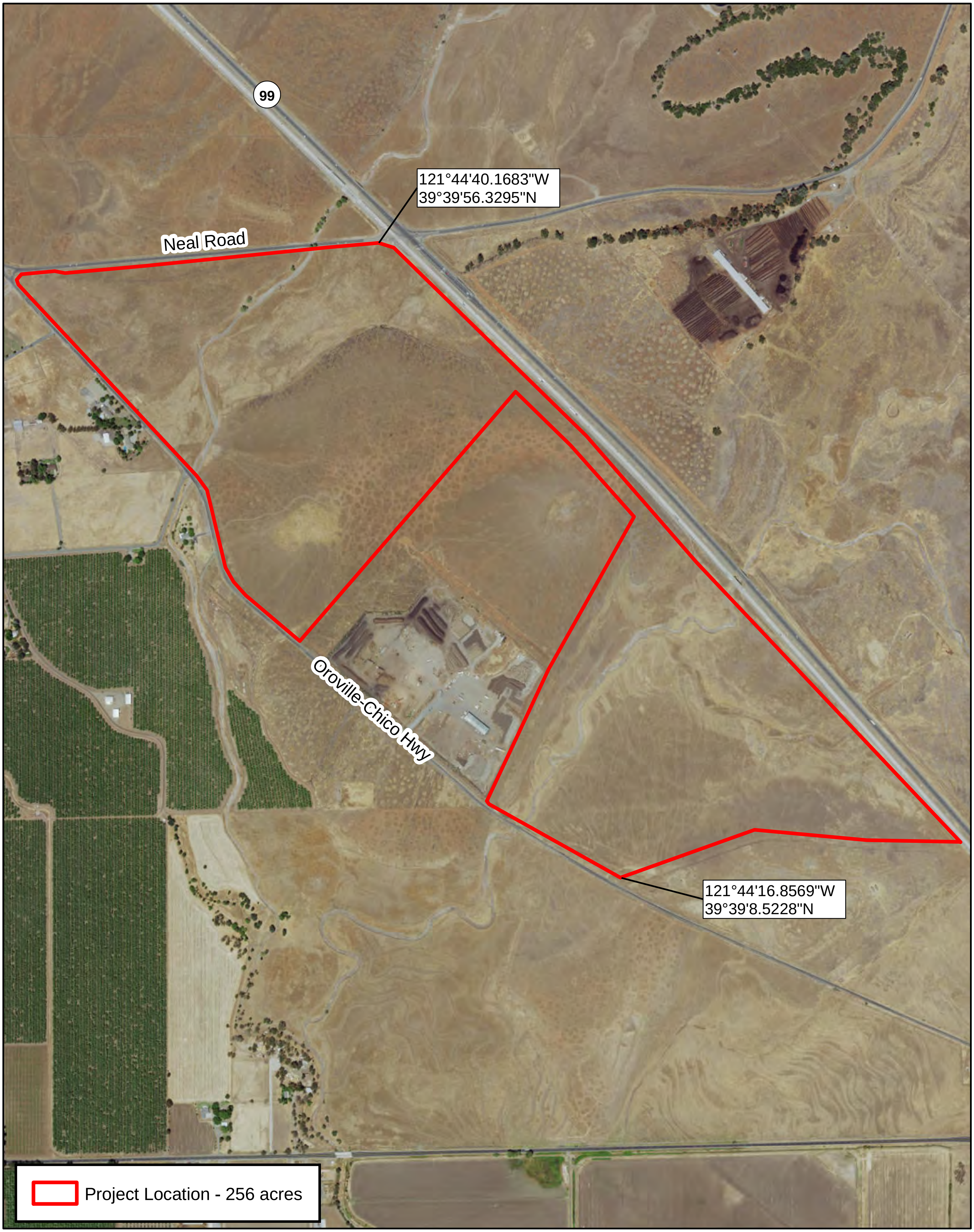
The average annual precipitation is 18.62 inches and the average annual temperature is 61.6° F (WRCC 2016) in the region where the survey area is located. The Property ranges in elevation from 163 to 224 feet above sea level and is sloped between 0-30 percent. Soils within the survey area are gravelly loams and clay loams with a restrictive layer ranging from 2 to 60 inches in depth (NRCS 2016).



1:24,000
0 500 1,000 Feet
NORTH
Data Sources: Esri, Butte County

Old Durham Wood
Regional Location Map
Figure 1

gallaway ENTERPRISES
GEP#:16-170 Map Date: 12/09/16



NORTH

1:11,500

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Data Sources: Esri, Butte County

Old Durham Wood
Project Location Map
Figure 2

gallaway ENTERPRISES

GEP#:16-170 Map Date: 12/09/16

Survey Methodology

The entire Property was surveyed both on-foot and ATV by Gallaway Enterprises staff on December 21, 2016 and January 5 and 17, 2017 to identify any potentially jurisdictional features. The survey, mapping efforts, and report production were performed according to the valid legal definitions of waters of the United States (WOTUS) in effect on December 21, 2016. The boundaries of non-tidal, non-wetland waters, when present, were delineated at the ordinary high water mark (OHWM) as defined in 33 Code of Federal Regulations (CFR) 328.3. The OHWM represents the limit of United States Army Corps of Engineers (Corps) jurisdiction over non-tidal waters (e.g., streams and ponds) in the absence of adjacent wetlands (33 CFR 328.04) (Curtis, et. al. 2011). Historic aerial photographs were analyzed prior to conducting the field visit. Areas identified as having potential wetland signatures were assessed in the field to determine the current conditions.

Due to the large size of the survey area, transects were established and field data was recorded only for the wetland features that intercepted the transect lines or within test pit sampling areas. Three transects were established within the Property perpendicular to the main drainage as per the USACE Wetlands Delineation Manual (1987). Field data were entered onto data sheets using the most current format (**Appendix A**). Wetland perimeters based on the *United States Army Corps of Engineers Wetlands Delineation Manual* (1987) and the *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Arid West Region* (2008) (Arid West Manual) were recorded and defined according to their topographic and hydrologic orientation. Test pit sampling was performed in areas displaying potential wetland signatures on past aerial photographs and problem areas. Test pit sampling points involved physical sampling of soils and vegetation, and investigation regarding hydrological connectivity. Only areas exhibiting the necessary wetland parameters according to the Arid West Manual on the date surveyed were mapped as wetlands. Photographs were taken to show wetland features, test pit areas, and/or areas identified as having historic wetland signatures. The locations of the photo points are depicted in **Figure 3** and the associated photographs are provided at the end of the report.

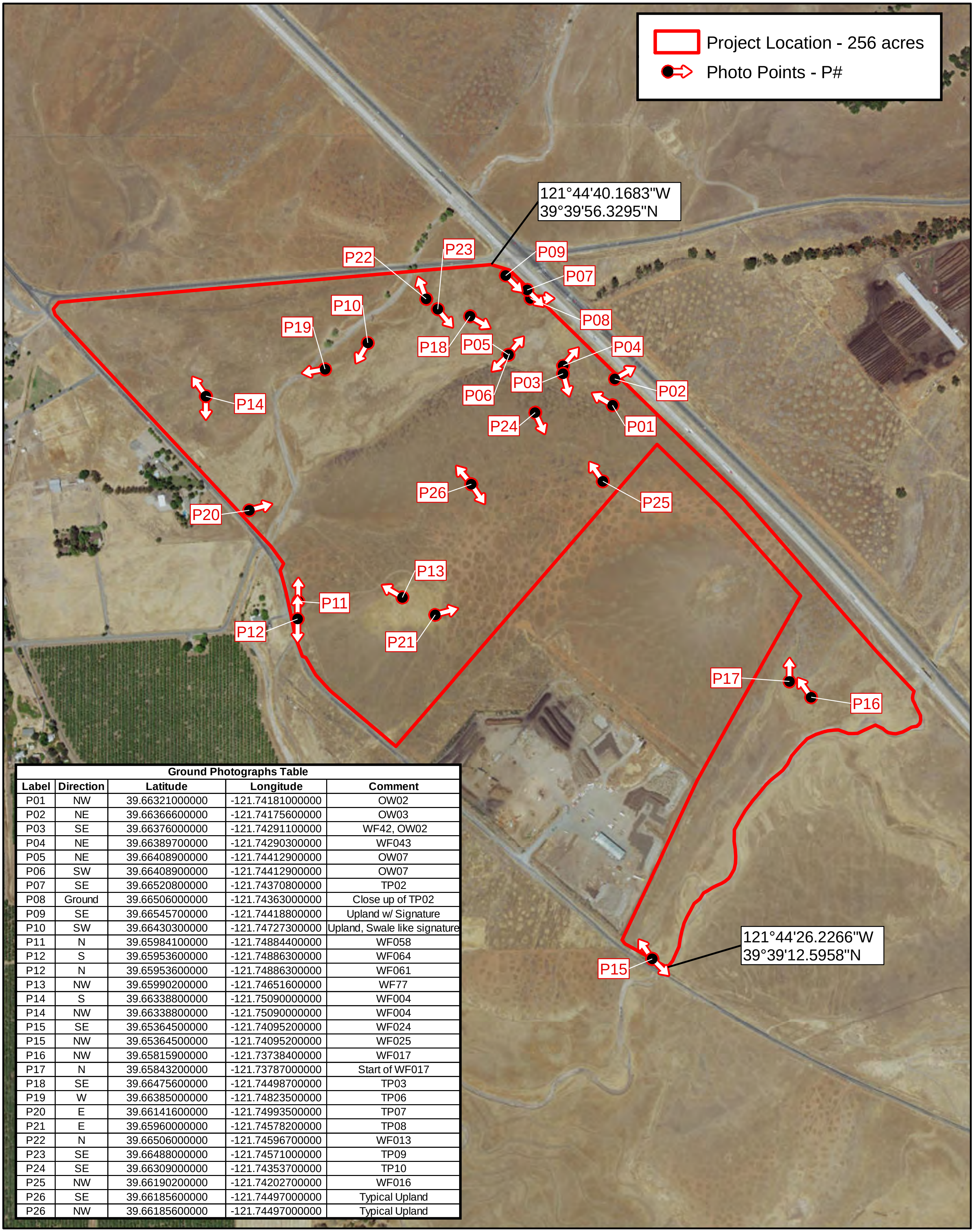
Many of the terms used throughout this report have specific meanings relating to the federal wetland delineation process. Term definitions are based on the Corps *Wetlands Delineation Manual* (1987); the Arid West Manual; *Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States, (2008)* and the Corps *Jurisdictional Determination Form Instructional Guidebook* (2007). The terms defined below have specific meaning relating to the delineation of Waters of the U.S. as described in 33 CFR Part 328 and 40 CFR Parts 110, 112, and 116, and 122.

Determination of Hydrophytic Vegetation

The presence of hydrophytic vegetation was determined using the methods outlined in the Corps *Wetlands Delineation Manual* (1987) and the Arid West Manual. Areas were considered to have positive indicators of hydrophytic vegetation if they pass the dominance test, meaning more than 50 percent of the dominant species are obligate wetland, facultative wetland, and facultative plants. Plant species were identified to the lowest taxonomy possible. Plant indicator status was determined by reviewing the State of California 2016 Wetland Plant List for the Arid West Region. In situations where dominance can be misleading due to seasonality, the prevalence index will be used to determine hydrophytic status of the community surrounding sample sites.

Plant indicator status categories:

Obligate wetland plants (OBL) – plants that occur almost always (estimated probability 99%) in wetlands under normal conditions, but which may also occur rarely (estimated probability 1%) in non-wetlands.



Ground Photographs Table

Label	Direction	Latitude	Longitude	Comment
P01	NW	39.66321000000	-121.74181000000	OW02
P02	NE	39.66366600000	-121.74175600000	OW03
P03	SE	39.66376000000	-121.74291100000	WF42, OW02
P04	NE	39.66389700000	-121.74290300000	WF043
P05	NE	39.66408900000	-121.74412900000	OW07
P06	SW	39.66408900000	-121.74412900000	OW07
P07	SE	39.66520800000	-121.74370800000	TP02
P08	Ground	39.66506000000	-121.74363000000	Close up of TP02
P09	SE	39.66545700000	-121.74418800000	Upland w/ Signature
P10	SW	39.66430300000	-121.74727300000	Upland, Swale like signature
P11	N	39.65984100000	-121.74884400000	WF058
P12	S	39.65953600000	-121.74886300000	WF064
P12	N	39.65953600000	-121.74886300000	WF061
P13	NW	39.65990200000	-121.74651600000	WF77
P14	S	39.66338800000	-121.75090000000	WF004
P14	NW	39.66338800000	-121.75090000000	WF004
P15	SE	39.65364500000	-121.74095200000	WF024
P15	NW	39.65364500000	-121.74095200000	WF025
P16	NW	39.65815900000	-121.73738400000	WF017
P17	N	39.65843200000	-121.73787000000	Start of WF017
P18	SE	39.66475600000	-121.74498700000	TP03
P19	W	39.66385000000	-121.74823500000	TP06
P20	E	39.66141600000	-121.74993500000	TP07
P21	E	39.65960000000	-121.74578200000	TP08
P22	N	39.66506000000	-121.74596700000	WF013
P23	SE	39.66488000000	-121.74571000000	TP09
P24	SE	39.66309000000	-121.74353700000	TP10
P25	NW	39.66190200000	-121.74202700000	WF016
P26	SE	39.66185600000	-121.74497000000	Typical Upland
P26	NW	39.66185600000	-121.74497000000	Typical Upland

NORTH

1:9,500
0 500 1,000 Feet

Data Sources: Esri (Base map sourced: 02/13/17), Butte County

Old Durham Wood
Ground Photographs Map
Figure 3

gallaway ENTERPRISES

GEP#:16-170 Map Date: 02/13/17

Facultative wetland plants (FACW) - plants that usually occur (estimated probability 67% to 99%) in wetlands under normal conditions, but also occur (estimated probability 1% to 33%) in non-wetlands.

Facultative plants (FAC) – Plants with a similar likelihood (estimated probability 33% to 67%) of occurring in both wetlands and non-wetlands.

Facultative upland plants (FACU) – Plants that occur sometimes (estimated probability1% to 33%) in wetlands, but occur more often (estimated probability 67% to 99%) in non-wetlands.

Obligate upland plants (UPL) – Plants that occur rarely (estimated probability 1%) in wetlands, but occur almost always (estimated probability 99%) in non-wetlands under natural conditions.

Determination of Hydric Soils

Soil survey information was reviewed for the current site condition. Field samples were evaluated using the Munsell soil color chart (2009 Edition), hand texturing, and assessment of soil features (e.g. oxidized root channels, evidence of hardpan, Mn and Fe concretions). Information regarding local soil and series descriptions is provided in **Appendix B.** A few test pits (**Appendix A**) were dug within portions of the site that appeared to have wetland aerial signatures, or evidence of drainage-like topography, but did not meet the wetland test parameters upon investigation in the field, even when drought procedures were used.

Determination of Wetland Hydrology

Wetland hydrology was determined to be present if a site supported one or more of the following characteristics:

- Landscape position and surface topography (e.g. position of the site relative to an up-slope water source, location within a distinct wetland drainage pattern, and concave surface topography),
- Inundation or saturation for a long duration either inferred based on field indicators or observed during repeated site visits, and
- Residual evidence of ponding or flooding resulting in field indicators such as scour marks, sediment deposits, algal matting, surface soil cracks and drift lines.

The presence of water or saturated soil for approximately 12% of the growing season typically creates anaerobic conditions in the soil, and these conditions affect the types of plants that can grow and the types of soils that develop (Wetland Training Institute 1995).

Determination of Ordinary High Water Mark

Gallaway utilized methods consistent with the Arid West Manual and *Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States, (2008)* to determine the OHWM. The lateral extents of non-tidal water bodies (e.g. intermittent and ephemeral streams) were based on the OHWM, which is “the line on the shore established by the fluctuations of water” (Corps 2005). The OHWM was determined based on multiple observed physical characteristics of the area, which can include scour, multiple observed flow events (from current and historical aerial photos), shelving, and changes in the character of soil, presence of mature vegetation, deposition, and topography. Due to the wide extent of some floodplains, adjacent riparian scrub areas characterized by hydric soils, hydrophytic vegetation, and hydrology may be included within the OHWM of a non-tidal water body (Curtis, et. al. 2011). Inclusion of minor special aquatic areas is an acceptable practice as outlined in the Arid West Manual.

OHWM Transects:

Representative OHWM widths measured in the field are shown as transect lines (**Exhibit A**) and measured in feet as required by the Corps *Final Map and Drawing Standards for the South Pacific Division Regulatory Program (2012)*. These transect lines are used to ensure that the other waters of the United States identified within the Property are mapped and calculated at the appropriate average width for each channel segment based on the Corps definition of OHWM as defined in the Arid West OHWM Field Guide and the *Ordinary High Water Mark Identification RGL 05-05 (2005)* (RGL 05-05). When the average width of a feature changes, this change is shown on the delineation map as a feature transition and a new average channel width is determined. At each transect line Gallaway uses multiple observed physical indicators in determining the OHWM. The lateral extents of the transect lines identify the location of the OHWM where benches, drift, exposed root hairs, changes in substrate/particle size, and, if appropriate, changes in vegetation were observed. If any other physical indicators as described in the Arid West OHWM Field Guide or RGL 05-05 are observed, these indicators are also utilized to help determine the location of the OHWM.

Jurisdictional Boundary Determination and Acreage Calculation

The wetland-upland boundary was determined based on the presence or inference of positive indicators of all mandatory criteria. Soil samples were taken within wetland and upland areas. The site was traversed on foot to identify wetland features and boundaries. The spatial data obtained during the preparation of this wetland delineation was collected using a Trimble Geo Explorer 6000 Series GPS Receiver. No readings were taken with fewer than 5 satellites. Point data locations were recorded for at least 25 seconds at a rate of 1 position per second. Area and line data were recorded at a rate of 1 position per second while walking at a slow pace. All GPS data were differentially corrected for maximum accuracy. In some cases, when visual errors and degrees of precision are identified due to environmental factors negatively influencing the precision of the GPS instrument (i.e. dense tree cover, steep topography, and other factors affecting satellite connection) mapping procedures utilized available topographic and aerial imagery datasets in order to improve accuracy in feature alignment and location.

Determination of Wetland Boundaries During a Drought

In California, the winter of 2015/2016 was considered a normal rainfall year (NOAA 2016) and the winter of 2016 to January 2017 also had sufficient rainfall, with even a few 100-year flood events. As such, the methods of delineating wetlands during drought conditions were not employed within the Property.

Determination of Wetland in Difficult Wetland Situations

The Property has not been man-altered and no difficult wetland situations occur within the Property. Therefore, the conditions on the site were not considered atypical and procedures for analyzing the site as atypical were not used. A few portions of the Property contained soils with red parent material, which can be considered a problem soil. In areas where the soils were within the color range to be considered red parent material, redox depletions and manganese masses were looked for and the soil was analyzed at the proper moisture level (if necessary the soil was collected and allowed to dry sufficiently before analyzing). Gallaway Enterprises mapped these areas as wetlands if hydric soil indicators were detected and at least one other hydric indicator was present (i.e. wetland hydrology or hydrophytic vegetation).

Non-Jurisdictional Boundary Determination and Acreage Calculation

Areas were determined to be potentially non-jurisdictional if they did not meet the wetland test parameters or were consistent with the description of non-jurisdictional features as presented in the Corps *Jurisdictional Determination Form Instructional Guidebook* (2007). No potentially non-jurisdictional features were identified within the Property. There were a number of areas that exhibited potential wetland signatures, however, based on data collected at these locations (**Appendix A**), the areas lacked the necessary wetland parameters and were not mapped as features.

Results

Table 1 Summarizes the area calculations for the pre-jurisdictional features within the Property. A complete Draft Wetland Delineation map, utilizing a 1" to 100' scale, is included as **Exhibit A**.

Table 1. Results Summary from the Delineation of Waters of the United States for the Old Durham Wood Expansion Parcels, Butte County, CA.

Draft Delineation of Waters of the U.S.			
Type	**Length (ft)**	**Area (sq ft)**	**Acres**
Other Waters of the US Totals =	11,414.2	290,338.3	6.67
Seasonal Swale Totals =	NA	64,018.7	1.47
Seasonal Wetland Totals =	NA	2,782.3	0.06
Vernal Swale Totals =	NA	268,435.1	6.16
Vernal Pool Totals =	NA	87,676.2	2.01
Other Waters and Wetland Features Totals =	**11,414.2**	**713,250.6**	**16.37**

Waters of the United States: Other Waters

There are a total of 8 features that are identified as other waters of the United States within the Property. Other waters of the United States are seasonal or perennial water bodies, including lakes, stream channels, ephemeral and intermittent drainages, ponds, and other surface water features that exhibit an ordinary high-water mark, but lack positive indicators for one or more of the three wetland parameters (hydrophytic vegetation, hydric soil, and wetland hydrology) (33 CFR 328.4). The boundaries of all other waters identified within the survey area were delineated based on the observed OHWM, including physical characteristics such as natural lines impressed on the bank, shelving, changes in the character of the soil, the destruction of terrestrial vegetation, debris lines and other appropriate indicators.

Of the other water features present within the Property, 4 have been identified as Relatively Permanent Waters (RPW). Relatively Permanent Waters are defined as tributaries that typically flow for at least 3 months of the year and have a documented hydrologic connection to a Traditionally Navigable Water (TNW). These RPWs include Hamlin Slough (OW 05), which is a tributary of Butte Creek and 3 unnamed tributaries of Hamlin Slough (OW 06-08). Flowing water was observed in the RPW during the December field visit.

The remaining 4 other water features have been identified as Non-relatively Permanent Waters (NRPW). Non-relatively Permanent Waters are defined as tributaries that flow for less than 3 months and have a documented hydrologic connection to a RPW or TNW. The NRPWs present within the Property are all unnamed tributaries of Hamlin Slough. All of the NRPWs identified within the Property contain appropriate morphology of bed, bank and scour. Flowing water was observed within all of the NRPWs during the December field visit.

Waters of the United States: Wetlands

The wetlands identified on the site are characterized as vernal pools, vernal swales, seasonal swales and seasonal wetlands (**Exhibit A**). Vernal pools are depressional features that are formed where a shallow hardpan prevents water from draining down though the soil. Within the Property, the hardpan consisted of a cemented duripan in the fan terraces associated with the drainages or a bedrock from historic lava flows in the terraces and higher ridgetops. Swales are low drainage pathways that typically connect to and help feed wetland or other water features. Seasonal wetlands are depressional features that pond water for longer duration than vernal pools and dry during the summer months.

All of the wetlands identified on the Property exhibited all three of the wetland parameters (**Appendix A**). A total of 167 wetland features were identified within the Property including 2.01 acres of vernal pools, 6.16 acres of vernal swales, 1.47 acres of seasonal swales and 0.06 acre of seasonal wetlands.

During the aerial photography review of the Property conducted prior to the field visit, it was evident that mound-swale topography dominated the terraces and ridgetops and a number of areas were identified that exhibited potential wetland signatures throughout the site. Upon field investigation of the ridgetops, very few wetlands were present due to the gradual slope present in these areas and the thin soils that resulted in rapid evaporation of water off the site. Where aerial photographs identified potential wetlands, but were found to lack wetland parameters when ground-truthed, test pits were taken (**Exhibit A** and **Appendix A**). Photo points were taken at test pit locations and at other locations across the site to depict the site conditions (**Figure 3**).

Soils

Gallaway collected soil data at various locations throughout the Property. Field observations of soil characteristics included soil color, texture, structure, and the visual assessment of soil features (e.g. the presence, or absence of redoximorphic features and the depth of restrictive layers such as hardpans). Field observations of soil characteristics at the test pit sites are included in the data sheet forms presented in **Appendix A**. Gallaway's soil texture evaluations rendered predominately loams and clay loams.

The geographic region in which the Property is found is often characterized as having a naturally occurring restrictive layer composed of cemented duripans and lithic and paralithic bedrock. Hardpans restrict root growth, limit water infiltration, and cause perching of the water table in certain locations. Gallaway queried the National Cooperative Soil Survey database to further evaluate the current soil conditions. A copy of the soil survey map and a description of mapped soil units for the Property are included as **Appendix B**. Eight soil map units occur within the Property. The 8 identified map units are listed below in **Table 2**. Based on Gallaway's review, all but one of the soil map units identified within the Property contain minor amounts (1 to 18%) of hydric components. A copy of the soil survey map and a description of mapped soil units for the Property are included as **Appendix B**.

Table 2. Soil Map Units, NRCS hydric soil designation, and approximate totals for the Old Durham Wood Expansion Parcels, Butte County, CA.

Map Unit Symbol	Map Unit Name	% Hydric Component in Map Unit	Landform of Hydric Component	% Map Unit in Survey Area
301	Wafap-Hamslough, 0 to 2 percent slopes	18	Stream terraces	18.2%
302	Redtough-Redswale, 0 to 2 percent slopes	8	Fan terraces	15.5%
614	Doemill-Jokerst, 0 to 3 percent slopes	2	Ridges	35.9%
615	Doemill-Jokerst, 3 to 8 percent slopes	1	Ridges	7.4%
616	Jokerst-Doemill-Typic Haploxeralfs, 8 to 15 percent slopes	N/A	N/A	7.9%
622	Xerorthents, shallow-Typic Haploxeralfs-Rock outcrop, cliffs complex, 15 to 30 percent slopes	2	Canyons	1.8%
675	Clearhayes-Hamslough, 0 to 2 percent slopes	18	Strath terraces	13.2%
679	Lucksev-Butteside-Carhart, 2 to 15 percent slopes	17	Hills	0.1%

Vegetation

During the December/January site visits, identifiable vegetation within the wetlands present included yellow carpet (*Blennosperma nanum*) (FACW), Mediterranean barley (*Hordeum marinum ssp. gussoneanum*) (FAC), Italian ryegrass (*Festuca perennis*) (FAC), and hawkbit (*Leontodon saxatilis*) (FACU). In the upland portions of the site, vegetation was dominated by yellow-star thistle (*Centaurea solstitialis*) (UPL), medusahead (*Elymus caput-medusae*) (UPL), soft chess (*Bromus hordeaceous*) (UPL), Fitch's spikeweed (*Centromadia fitchii*) (FACU), lowland shooting star (*Primula clevelandii var. patula*) (NL), and long-beaked stork's-bill (*Erodium botrys*) (FACU).

Hydrology

Precipitation and localized surface runoff function as the main hydrological inputs for the waters of the U.S located within the Property. All of the wetlands and the NRPWs identified on the site drain into Hamlin Slough (OW 05) or one of the unnamed tributaries of Hamlin Slough (OW 06-08). Hamlin Slough is a tributary of Butte Creek, which in turn is a tributary of the Sacramento River (a TNW).

During the December and January field visits, water was pooling within almost all of the wetland features and soils were wet and/or saturated due to a significant rain event that occurred the week prior to the field visit.

Site Photos Taken on December 21, 2016, January 5, 2017 and January 17, 2017

P 01 – OW02 looking northwest

P 02 – OW03 looking northeast

P 03 – OW02 and WF042 looking southeast

P 04 – WF043 looking northeast

P 05 –OW07 looking northeast

P 06 –OW07 looking southwest

P 07 – TP02 looking southeast

P 08 – Close up of area around TP02

P 09 – Upland looking slightly southeast

P 10 – Upland with a swale-like signature looking southwest

P 11 – WF058 looking north

P 12 – WF064 looking south

P 12 –WF061 looking north

P 13 – WF077 looking northwest

P 14 – WF004 looking south

P 14 – WF004 looking northwest

P 15 –WF024 looking southeast

P 18 – TP03 looking southeast

P 15 – WF025 looking northwest

P 19 – TP06 looking west

P 16 – WF017 looking northwest

P 20 – TP07 looking east

P 17 – Start of WF017 looking north

P 21 – TP08 looking east


P 22 – WF013 looking north


P 25 – WF016 looking northwest


P 23 – TP09 looking southeast


P 26 – Typical upland looking southeast


P 24 – TP 10 looking southeast


P 26 – Typical upland looking northwest

Glossary

Abutting: When referring to wetlands that are adjacent to a tributary, abutting defines those wetlands that are not separated from the tributary by an upland feature, such as a berm or dike.

Adjacent: Adjacent as used in "Adjacent to traditional navigable water," is defined in Corps and EPA regulations as "bordering, contiguous, or neighboring." Wetlands separated from other waters of the U.S. by man-made dikes or barriers, natural river berms, beach dunes and the like are 'adjacent wetlands. A wetland "abuts" a tributary if it is not separated from the tributary by uplands, a berm, dike, or similar feature.

While all wetlands that meet the agencies' definitions are considered adjacent wetlands, only those adjacent wetlands that have a continuous surface connection because they directly abut the tributary (e.g., they are not separated by uplands, a berm, dike, or similar feature) are considered jurisdictional under the plurality standard. (CWA Jurisdiction Following Rapanos v US and Carabell v US 12-02-08).

The regulations define "adjacent" as follows: "[t]he term adjacent means bordering, contiguous, or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are 'adjacent wetlands.'" Under this definition, a wetland does not need to meet all criteria to be considered adjacent. The agencies consider wetlands to be bordering, contiguous, or neighboring, and therefore "adjacent" if at least one of following three criteria is satisfied:

(1) There is an unbroken surface or shallow sub-surface hydrologic connection between the wetland and jurisdictional waters; or

(2) The wetlands are physically separated from jurisdictional waters by "manmade dikes or barriers, natural river berms, beach dunes, and the like;" or,

(3) Where a wetland's physical proximity to a jurisdictional water is reasonably close, that wetland is "neighboring" and thus adjacent. For example, wetlands located within the riparian area or floodplain of a jurisdictional water will generally be considered neighboring, and thus adjacent. One test for whether a wetland is sufficiently proximate to be considered "neighboring" is whether there is a demonstrable ecological interconnection between the wetland and the jurisdictional waterbody. For example, if resident aquatic species (e.g., amphibians, reptiles, fish, mammals, or waterfowl) rely on both the wetland and the jurisdictional waterbody for all or part of their life cycles (e.g., nesting, rearing, feeding, etc.), that may demonstrate that the wetland is neighboring and thus adjacent. The agencies recognize that as the distance between the wetland and jurisdictional water increases, the potential ecological interconnection between the waters is likely to decrease.

The agencies will also continue to assert jurisdiction over wetlands "adjacent" to traditional navigable waters as defined in the agencies' regulations. Under EPA and Corps regulations and as used in this guidance, "adjacent" means "bordering, contiguous, or neighboring." Finding a continuous surface connection is not required to establish adjacency under this definition. The Rapanos decision does not affect the scope of jurisdiction over wetlands that are adjacent to traditional navigable waters. The agencies will assert jurisdiction over those adjacent wetlands that have a continuous surface connection with a relatively permanent, non-navigable tributary, without the legal obligation to make a significant nexus finding.

Atypical situation (significantly disturbed): In an atypical (significantly disturbed) situation, recent human activities or natural events have created conditions where positive indicators for hydrophytic vegetation, hydric soil, or wetland hydrology are not present or observable.

Boulder. Rock fragments larger than 60 .4 cm (24 inches) in diameter.

Channel. "An open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water" (Langbein and Iseri 1960:5).

Channel bank. The sloping land bordering a channel. The bank has steeper slope than the bottom of the channel and is usually steeper than the land surrounding the channel.

Cobbles. Rock fragments 7.6 cm (3 inches) to 25 .4 cm (10 inches) in diameter.

Debris flow. A moving mass of rock fragments, soil, and mud where more than 50% of the particles are larger than sand-sized.

Divide. High ground that forms the boundary of a watershed.

Drift. Organic debris oriented to flow direction(s) (larger than small twigs).

Effective discharge. Discharge that is capable of carrying a large proportion of sediment over time.

Emergent hydrophytes. Erect, rooted, herbaceous angiosperms that may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant; e.g., bulrushes (*Scirpus spp*.), salt marsh cord grass.

Emergent mosses. Mosses occurring in wetlands, but generally not covered by water.

Ephemeral stream. An ephemeral stream has flowing water only during and for a short duration after, precipitation events in a typical year. Ephemeral streambeds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Facultative wetland (FACW). Wetland indicator category; species usually occurs in wetlands (estimated probability 67–99%) but occasionally found in non-wetlands.

Flat. A level landform composed of unconsolidated sediments usually mud or sand. Flats may be irregularly shaped or elongate and continuous with the shore, whereas bars are generally elongate, parallel to the shore, and separated from the shore by water.

Floating plant. A non-anchored plant that floats freely in the water or on the surface; e.g., water hyacinth (*Eichhornia crassipes*) or common duckweed (*Lemna minor*).

Floating-leaved plant. A rooted, herbaceous hydrophyte with some leaves floating on the water surface; e.g., white water lily (*Nymphaea odorata*), floating-leaved pondweed (*Potamogeton natans*). Plants such as yellow water lily (*Nuphar luteum*) which sometimes has leaves raised above the surface are considered floating leaved plants or emergents, depending on their growth habit at a particular site.

Freshwater Emergent Wetland. Fresh emergent wetlands are characterized by erect, rooted herbaceous hydrophytes and are flooded frequently enough that the roots of the plants flourish in an anaerobic environment. They are most common on gently rolling topography yet also occur in depressions at the edges of rivers and lakes. Supportive soils tend to contain high amounts of silt and clay with coarser sediments and organic matter intermixed. Characteristic plant species include cattails (Typha sp.) and rushes (Scirpus sp.).

Gravel. A mixture composed primarily of rock fragments 2mm (0 .08 inch) to 7.6 cm (3 inches) in diameter. Usually contains much sand.

Growing season The frost-free period of the year (see U.S. Department of Interior, National Atlas 1970:110-111 for generalized regional delineation).

Herbaceous. With the characteristics of an herb; a plant with no persistent woody stem above ground.

Hydric soil. Soil is hydric that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic (oxygen-depleted) conditions in its upper part (i.e., within the shallow rooting zone of herbaceous plants).

Hydrophyte, **hydrophytic.** Any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Intermittent stream. An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Jurisdictional Wetland. Sites that meet the definition of wetland provided below and that fall under COE regulations pursuant to Section 404 of the CWA are considered jurisdictional wetlands.

Lacustrine. The Lacustrine System includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling less than 8 ha are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet) at low water. Lacustrine waters may be tidal or nontidal, but ocean-derived salinity is always less than 0.5 parts per thousand.

Litter. Organic debris oriented to flow direction(s) (small twigs and leaves).

Macrophytic algae. Algal plants large enough either as individuals or communities to be readily visible without the aid of optical magnification.

Man-induced wetlands. A man-induced wetland is an area that has developed at least some characteristics of naturally occurring wetlands due to either intentional or incidental human activities.

Mesophyte, mesophytic. Any plant growing where moisture and aeration conditions lie between extremes. (Plants typically found in habitats with average moisture conditions, not usually dry or wet.)

Non-persistent emergents. Emergent hydrophytes whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice. The breakdown may result from normal decay or the physical force of strong waves or ice. At certain seasons of the year there are no visible traces of the plants above the surface of the water; e.g., wild rice (*Zizania aquatica*), arrow arum (*Peltandra virginica*).

Non-Relatively Permanent Water: A non-relatively permanent water (NRPW) is defined as a tributary that is not a TNW and that typically flows for periods for less than 3 months. NRPWs are jurisdictional when the have a documented significant nexus to TNWs. All NRPWs must also contain appropriate morphology of bed, bank and scour and be clearly connected to a TNW.

Normal circumstances. This term refers to the soil and hydrologic conditions that are normally present, without regard to whether the vegetation has been removed.

Obligate hydrophytes. Species that are found only in wetlands e.g., cattail (*Typha latifolia*) as opposed to ubiquitous species that grow either in wetland or on upland-e .g., red maple (*Acer rubrum*).

Obligate wetland (OBL). Wetland indicator category; species occurs almost always (estimated probability 99%) under natural conditions in wetlands.

Other Waters of the United States. Other waters of the United States are seasonal or perennial water bodies, including lakes, stream channels, drainages, ponds, and other surface water features, that exhibit an ordinary high-water mark but lack positive indicators for one or more of the three wetland parameters (hydrophytic vegetation, hydric soil, and wetland hydrology) (33 CFR 328.4).

Palustrine the Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 parts per thousand. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m (6.6 feet) at low water; and (4) salinity due to ocean-derived salts is less than 0.5 parts per thousand.

Perennial stream. A perennial stream has flowing water year-round during atypical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Persistent emergent. Emergent hydrophytes that normally remain standing at least until the beginning of the next growing season; e.g. ., cattails (*Typha spp*.) or bulrushes (*Scirpus spp.*).

Pioneer species. A species that colonizes a previously uncolonized area.

Ponded. Ponding is a condition in which free water covers the soil surface (e.g., in a closed depression) and is removed only by percolation, evaporation, or transpiration.
Problem area. Problem areas are those where one or more wetland parameters may be lacking because of normal seasonal or annual variations in environmental conditions that result from causes other than human activities or catastrophic natural events**.**

Relatively Permanent Waters of the U.S. Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months)

Ruderals. Disturbance-adapted herbaceous plant.

Scour. Soil and debris movement.

Sheetflood. Sheet of unconfined floodwater moving down a slope; a relatively low-frequency, high-magnitude event.

Sheetflow. Overland flow occurring in a continuous sheet; a relatively high-frequency, low-magnitude event.

Shrub. A woody plant which at maturity is usually less than 6 m(20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance ; e.g., speckled alder (*Alnus rugosa*) or buttonbush (*Cephalanthus occidentalis*).

Succession. Changes in the composition or structure of an ecological community.

Stone. Rock fragments larger than 25 .4 cm (10 inches) but less than 60 .4 cm (24 inches).

Submergent plant. Avascular or nonvascular hydrophyte, either rooted or non-rooted, which lies entirely beneath the water surface, except for flowering parts in some species; e.g., wild celery (*Vallisneria americana*) or the stoneworts (*Chara spp*.).

Traditional Navigable Waters (TNWs)."[a]ll waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide." These waters are referred to in this guidance as traditional navigable waters. The traditional navigable waters include all of the "navigable waters of the United States," as defined in 33 C.F.R. Part 329 and by numerous decisions of the federal courts, plus all other waters that are navigable-in-fact (for example, the Great Salt Lake, UT, and Lake Minnetonka, MN). Thus, the traditional navigable waters include, but are not limited to, the "navigable waters of the United States" within the meaning of Section 10 of the Rivers and Harbors Act of 1899 (also known as "Section 10 waters").

Tree. A woody plant which at maturity is usually 6 m (20 feet) or more in height and generally has a single trunk, unbranched for 1 m or more above the ground, and a more or less definite crown; e.g., red maple (*Acer rubrum*), northern white cedar (*Thuja occidentalis*).

Water table. The upper surface of a zone of saturation . No water table exists where that surface is formed by an impermeable body (Langbein and Iseri 1960:21).

Waters of the United States. This is the encompassing term for areas under federal jurisdiction pursuant to Section 404 of the CWA. Waters of the United States are divided into "wetlands" and "other waters of the United States".

Watershed (drainage basin). An area of land that drains to a single outlet and is separated from other watersheds by a divide.

Wetland. Wetlands are defined as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3 [b], 40 CFR 230.3). To be considered under federal jurisdiction, a wetland must support positive indicators for hydrophytic vegetation, hydric soil, and wetland hydrology.

Woody plant. A seed plant (gymnosperm or angiosperm) that develops persistent, hard, fibrous tissues, basically xylem; e.g., trees and shrubs.

Xeric. Relating or adapted to an extremely dry habitat

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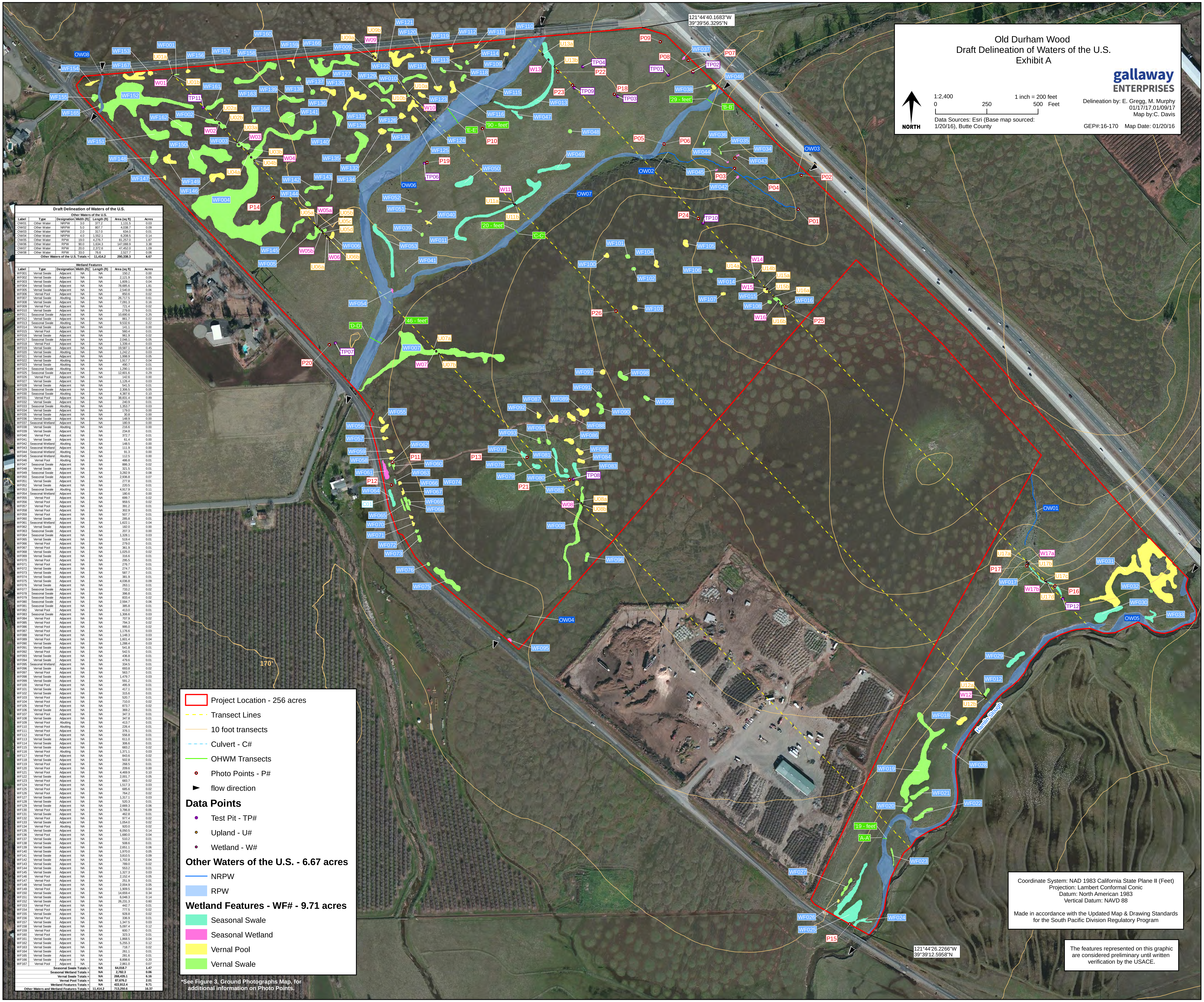
APPENDIX A AVAILABLE UPON REQUEST

APPENDIX B AVAILABLE UPON REQUEST

Exhibit A: Draft Delineation of Waters of the U.S. Map



Old Durham Wood
Draft Delineation of Waters of the U.S.
Exhibit A

gallaway ENTERPRISES

NORTH

1:2,400
1 inch = 200 feet
0 250 500 Feet

Data Sources: Esri (Base map sourced: 1/20/16), Butte County

Delineation by: E. Gregg, M. Murphy
01/17/17,01/09/17
Map by:C. Davis

GEP#:16-170 Map Date: 01/20/16

Draft Delineation of Waters of the U.S.

Other Waters of the U.S.						
Label	Type	Designation	Width (ft)	Length (ft)	Area (sq ft)	Acres
OW01	Other Water	NRPW	3.0	377.2	1,131.5	0.03
OW02	Other Water	NRPW	5.0	807.7	4,038.7	0.09
OW03	Other Water	NRPW	2.0	317.0	634.0	0.01
OW04	Other Water	NRPW	4.0	1,552.1	6,208.5	0.14
OW05	Other Water	RPW	19.0	4,276.7	81,257.0	1.87
OW06	Other Water	RPW	90.0	1,634.3	147,088.9	3.38
OW07	Other Water	RPW	20.0	2,372.6	47,452.0	1.09
OW08	Other Water	RPW	33.0	76.6	2,527.7	0.06
			Other Waters of the U.S. Totals =	11,414.2	290,338.3	6.67

Wetland Features						
Label	Type	Designation	Width (ft)	Length (ft)	Area (sq ft)	Acres
WF001	Vernal Swale	Adjacent	NA	NA	150.2	0.00
WF002	Vernal Swale	Adjacent	NA	NA	2,121.9	0.05
WF003	Vernal Swale	Adjacent	NA	NA	1,609.1	0.04
WF004	Vernal Swale	Adjacent	NA	NA	78,685.6	1.81
WF005	Vernal Swale	Adjacent	NA	NA	2,540.8	0.06
WF006	Vernal Pool	Adjacent	NA	NA	850.6	0.02
WF007	Vernal Swale	Abutting	NA	NA	26,717.5	0.61
WF008	Vernal Swale	Adjacent	NA	NA	7,091.3	0.16
WF009	Vernal Pool	Adjacent	NA	NA	721.4	0.02
WF010	Vernal Swale	Adjacent	NA	NA	279.8	0.01
WF011	Seasonal Swale	Adjacent	NA	NA	10,690.6	0.25
WF012	Vernal Swale	Adjacent	NA	NA	861.7	0.02
WF013	Seasonal Swale	Abutting	NA	NA	9,532.6	0.22
WF014	Vernal Swale	Adjacent	NA	NA	141.1	0.00
WF015	Vernal Pool	Adjacent	NA	NA	560.4	0.01
WF016	Vernal Swale	Adjacent	NA	NA	961.9	0.02
WF017	Seasonal Swale	Adjacent	NA	NA	2,046.1	0.05
WF018	Vernal Pool	Adjacent	NA	NA	1,339.4	0.03
WF019	Vernal Swale	Adjacent	NA	NA	19,587.1	0.45
WF020	Vernal Swale	Abutting	NA	NA	1,242.2	0.03
WF021	Vernal Swale	Adjacent	NA	NA	1,998.9	0.05
WF022	Vernal Swale	Abutting	NA	NA	1,917.7	0.04
WF023	Vernal Swale	Abutting	NA	NA	490.7	0.01
WF024	Seasonal Swale	Abutting	NA	NA	1,290.1	0.03
WF025	Seasonal Swale	Adjacent	NA	NA	12,601.6	0.29
WF026	Vernal Pool	Adjacent	NA	NA	142.6	0.00
WF027	Vernal Swale	Adjacent	NA	NA	1,126.4	0.03
WF028	Vernal Swale	Adjacent	NA	NA	541.5	0.01
WF029	Seasonal Swale	Adjacent	NA	NA	2,306.5	0.05
WF030	Seasonal Swale	Abutting	NA	NA	4,387.6	0.10
WF031	Vernal Pool	Adjacent	NA	NA	38,831.4	0.89
WF032	Vernal Swale	Adjacent	NA	NA	240.9	0.01
WF033	Seasonal Swale	Abutting	NA	NA	1,353.7	0.03
WF034	Vernal Swale	Adjacent	NA	NA	179.0	0.00
WF035	Vernal Swale	Adjacent	NA	NA	30.8	0.00
WF036	Vernal Swale	Adjacent	NA	NA	148.9	0.00
WF037	Seasonal Wetland	Adjacent	NA	NA	180.9	0.00
WF038	Vernal Swale	Abutting	NA	NA	216.6	0.00
WF039	Vernal Swale	Adjacent	NA	NA	234.8	0.01
WF040	Vernal Pool	Adjacent	NA	NA	372.7	0.01
WF041	Vernal Swale	Adjacent	NA	NA	61.4	0.00
WF042	Seasonal Wetland	Abutting	NA	NA	148.5	0.00
WF043	Seasonal Wetland	Adjacent	NA	NA	111.9	0.00
WF044	Seasonal Wetland	Abutting	NA	NA	91.3	0.00
WF045	Seasonal Wetland	Abutting	NA	NA	112.5	0.00
WF046	Vernal Pool	Abutting	NA	NA	486.8	0.01
WF047	Seasonal Swale	Adjacent	NA	NA	886.3	0.02
WF048	Vernal Swale	Adjacent	NA	NA	321.5	0.01
WF049	Seasonal Swale	Adjacent	NA	NA	3,282.9	0.08
WF050	Seasonal Swale	Adjacent	NA	NA	2,936.8	0.07
WF051	Vernal Swale	Adjacent	NA	NA	277.8	0.01
WF052	Vernal Swale	Adjacent	NA	NA	220.5	0.01
WF053	Seasonal Swale	Abutting	NA	NA	4,917.9	0.11
WF054	Seasonal Wetland	Adjacent	NA	NA	180.6	0.00
WF055	Vernal Pool	Adjacent	NA	NA	699.7	0.02
WF056	Vernal Pool	Adjacent	NA	NA	959.5	0.02
WF057	Vernal Pool	Adjacent	NA	NA	391.2	0.01
WF058	Vernal Pool	Adjacent	NA	NA	302.9	0.01
WF059	Vernal Pool	Adjacent	NA	NA	507.7	0.01
WF060	Vernal Swale	Adjacent	NA	NA	285.8	0.01
WF061	Seasonal Wetland	Adjacent	NA	NA	1,622.1	0.04
WF062	Vernal Swale	Adjacent	NA	NA	182.0	0.00
WF063	Seasonal Swale	Adjacent	NA	NA	207.3	0.00
WF064	Seasonal Swale	Adjacent	NA	NA	1,328.1	0.03
WF065	Vernal Swale	Adjacent	NA	NA	519.4	0.01
WF066	Vernal Pool	Adjacent	NA	NA	279.0	0.01
WF067	Vernal Pool	Adjacent	NA	NA	361.9	0.01
WF068	Vernal Swale	Adjacent	NA	NA	1,025.0	0.02
WF069	Vernal Swale	Adjacent	NA	NA	316.6	0.01
WF070	Vernal Pool	Adjacent	NA	NA	295.5	0.01
WF071	Vernal Pool	Adjacent	NA	NA	276.7	0.01
WF072	Vernal Swale	Adjacent	NA	NA	274.7	0.01
WF073	Vernal Swale	Adjacent	NA	NA	587.7	0.01
WF074	Vernal Swale	Adjacent	NA	NA	381.9	0.01
WF075	Vernal Swale	Adjacent	NA	NA	4,036.8	0.09
WF076	Vernal Swale	Adjacent	NA	NA	263.1	0.01
WF077	Seasonal Swale	Adjacent	NA	NA	733.2	0.02
WF078	Seasonal Swale	Adjacent	NA	NA	396.8	0.01
WF079	Seasonal Swale	Adjacent	NA	NA	833.4	0.02
WF080	Seasonal Swale	Adjacent	NA	NA	2,594.7	0.06
WF081	Seasonal Swale	Adjacent	NA	NA	385.8	0.01
WF082	Vernal Pool	Adjacent	NA	NA	413.0	0.01
WF083	Seasonal Swale	Adjacent	NA	NA	1,306.6	0.03
WF084	Vernal Pool	Adjacent	NA	NA	707.9	0.02
WF085	Vernal Pool	Adjacent	NA	NA	794.3	0.02
WF086	Vernal Pool	Adjacent	NA	NA	995.0	0.02
WF087	Vernal Pool	Adjacent	NA	NA	1,176.6	0.03
WF088	Vernal Pool	Adjacent	NA	NA	1,148.3	0.03
WF089	Vernal Pool	Adjacent	NA	NA	1,601.4	0.04
WF090	Vernal Swale	Adjacent	NA	NA	1,288.4	0.03
WF091	Vernal Swale	Adjacent	NA	NA	541.8	0.01
WF092	Vernal Pool	Adjacent	NA	NA	542.5	0.01
WF093	Vernal Swale	Adjacent	NA	NA	436.8	0.01
WF094	Vernal Swale	Adjacent	NA	NA	479.6	0.01
WF095	Seasonal Wetland	Adjacent	NA	NA	334.5	0.01
WF096	Vernal Swale	Adjacent	NA	NA	693.8	0.02
WF097	Vernal Pool	Adjacent	NA	NA	563.7	0.01
WF098	Vernal Swale	Adjacent	NA	NA	1,479.7	0.03
WF099	Vernal Swale	Adjacent	NA	NA	591.2	0.01
WF100	Vernal Pool	Adjacent	NA	NA	495.9	0.01
WF101	Vernal Swale	Adjacent	NA	NA	417.1	0.01
WF102	Vernal Swale	Adjacent	NA	NA	315.6	0.01
WF103	Vernal Pool	Adjacent	NA	NA	520.7	0.01
WF104	Vernal Pool	Adjacent	NA	NA	710.0	0.02
WF105	Vernal Pool	Adjacent	NA	NA	873.7	0.02
WF106	Vernal Swale	Adjacent	NA	NA	369.2	0.01
WF107	Vernal Pool	Adjacent	NA	NA	347.3	0.01
WF108	Vernal Swale	Adjacent	NA	NA	347.8	0.01
WF109	Vernal Pool	Abutting	NA	NA	413.7	0.01
WF110	Vernal Pool	Abutting	NA	NA	226.4	0.01
WF111	Vernal Pool	Adjacent	NA	NA	376.1	0.01
WF112	Vernal Pool	Adjacent	NA	NA	556.8	0.01
WF113	Vernal Swale	Adjacent	NA	NA	611.0	0.01
WF114	Vernal Swale	Adjacent	NA	NA	306.6	0.01
WF115	Vernal Swale	Adjacent	NA	NA	683.2	0.02
WF116	Vernal Pool	Abutting	NA	NA	1,371.1	0.03
WF117	Vernal Pool	Adjacent	NA	NA	843.6	0.02
WF118	Vernal Swale	Adjacent	NA	NA	502.8	0.01
WF119	Vernal Pool	Adjacent	NA	NA	268.5	0.01
WF120	Vernal Pool	Adjacent	NA	NA	209.6	0.00
WF121	Vernal Pool	Adjacent	NA	NA	4,469.9	0.10
WF122	Vernal Swale	Adjacent	NA	NA	2,001.7	0.05
WF123	Vernal Pool	Adjacent	NA	NA	683.7	0.02
WF124	Vernal Pool	Adjacent	NA	NA	1,517.3	0.03
WF125	Vernal Pool	Adjacent	NA	NA	685.6	0.02
WF126	Vernal Pool	Adjacent	NA	NA	764.2	0.02
WF127	Vernal Swale	Adjacent	NA	NA	1,317.1	0.03
WF128	Vernal Swale	Adjacent	NA	NA	520.3	0.01
WF129	Vernal Swale	Adjacent	NA	NA	2,669.3	0.06
WF130	Vernal Pool	Adjacent	NA	NA	3,786.8	0.09
WF131	Vernal Swale	Adjacent	NA	NA	462.8	0.01
WF132	Vernal Pool	Adjacent	NA	NA	977.4	0.02
WF133	Vernal Swale	Adjacent	NA	NA	1,054.0	0.02
WF134	Vernal Pool	Abutting	NA	NA	920.0	0.02
WF135	Vernal Swale	Adjacent	NA	NA	6,050.5	0.14
WF136	Vernal Pool	Adjacent	NA	NA	1,680.0	0.04
WF137	Vernal Swale	Adjacent	NA	NA	510.2	0.01
WF138	Vernal Swale	Adjacent	NA	NA	508.6	0.01
WF139	Vernal Swale	Adjacent	NA	NA	2,651.1	0.06
WF140	Vernal Swale	Adjacent	NA	NA	1,970.0	0.05
WF141	Vernal Swale	Adjacent	NA	NA	3,810.5	0.09
WF142	Vernal Swale	Adjacent	NA	NA	1,702.8	0.04
WF143	Vernal Swale	Adjacent	NA	NA	789.0	0.02
WF144	Vernal Swale	Adjacent	NA	NA	553.2	0.01
WF145	Vernal Swale	Adjacent	NA	NA	1,327.3	0.03
WF146	Vernal Pool	Adjacent	NA	NA	2,152.4	0.05
WF147	Vernal Pool	Adjacent	NA	NA	251.9	0.01
WF148	Vernal Swale	Adjacent	NA	NA	2,004.9	0.05
WF149	Vernal Pool	Adjacent	NA	NA	1,909.5	0.04
WF150	Vernal Swale	Adjacent	NA	NA	14,659.4	0.34
WF151	Vernal Swale	Adjacent	NA	NA	6,048.3	0.14
WF152	Vernal Swale	Adjacent	NA	NA	26,231.3	0.60
WF153	Vernal Pool	Adjacent	NA	NA	442.7	0.01
WF154	Vernal Pool	Adjacent	NA	NA	777.5	0.02
WF155	Vernal Swale	Adjacent	NA	NA	928.8	0.02
WF156	Vernal Pool	Adjacent	NA	NA	336.9	0.01
WF157	Vernal Swale	Adjacent	NA	NA	1,347.5	0.03
WF158	Vernal Swale	Adjacent	NA	NA	5,097.4	0.12
WF159	Vernal Pool	Adjacent	NA	NA	600.7	0.01
WF160	Vernal Pool	Adjacent	NA	NA	323.3	0.01
WF161	Vernal Swale	Adjacent	NA	NA	1,868.5	0.04
WF162	Vernal Swale	Adjacent	NA	NA	5,255.3	0.12
WF163	Vernal Swale	Adjacent	NA	NA	718.7	0.02
WF164	Vernal Swale	Adjacent	NA	NA	261.1	0.01
WF165	Vernal Swale	Adjacent	NA	NA	281.6	0.01
WF166	Vernal Swale	Adjacent	NA	NA	8,898.6	0.20
WF167	Vernal Pool	Adjacent	NA	NA	2,861.0	0.07
			Seasonal Swale Totals =	NA	64,018.7	1.47
			Seasonal Wetland Totals =	NA	2,782.3	0.06
			Vernal Swale Totals =	NA	268,435.1	6.16
			Vernal Pool Totals =	NA	87,676.2	2.01
			Wetland Features Totals =	NA	422,912.4	9.71
			Other Waters and Wetland Features Totals =	11,414.2	713,250.6	16.37

Project Location - 256 acres
Transect Lines
10 foot transects
Culvert - C#
OHWM Transects
Photo Points - P#
flow direction

Data Points

Test Pit - TP#
Upland - U#
Wetland - W#

Other Waters of the U.S. - 6.67 acres

NRPW
RPW

Wetland Features - WF# - 9.71 acres

Seasonal Swale
Seasonal Wetland
Vernal Pool
Vernal Swale

*See Figure 3, Ground Photographs Map, for additional information on Photo Points.

Coordinate System: NAD 1983 California State Plane II (Feet)
Projection: Lambert Conformal Conic
Datum: North American 1983
Vertical Datum: NAVD 88

Made in accordance with the Updated Map & Drawing Standards for the South Pacific Division Regulatory Program

The features represented on this graphic are considered preliminary until written verification by the USACE.

ATTACHMENT B

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GIS, Environmental, & Engineering Services

February 21, 2020

71730

Matthew Roberts
U.S. Army Corps of Engineers
310 Hemsted Drive, Suite 310
Redding, CA 96002

Via Email
Matthew.J.Roberts@usace.army.mil

RE: Draft Determination of Waters of the United States
Old Durham Wood (SPK-2013-01078)
Durham, California

Dear Mr. Roberts:

Please find attached a Draft Delineation of Waters of the United States (WOTUS) prepared for the Old Durham Wood, Inc., facility in Butte County, California. A Delineation of the Waters of the United States was originally prepared for the site by Gallaway Enterprises in October 2013, and a preliminary jurisdictional determination was issued for the property by the US Army Corps of Engineers on January 24, 2014 (PK-2013-01078). The Approved Jurisdictional Determination for the property was issued on June 5, 2017.

The purpose of the enclosed Draft Delineation of WOTUS delineation is to provide an update to the previous wetland delineation work that was completed in 2013. The site experienced ground disturbance in the summer of 2017 when CALFIRE fire fuel breaks were constructed across a 19-acre area adjacent to the Old Durham Wood facility in response to a wildfire. The fire breaks altered some of the wetland signatures that were characterized in previous wetland delineation work. The applicant wishes to reassess the extent of mitigation required within the 19-acre area based on this updated Draft Delineation of WOTUS prior to submittal of a nationwide permit.

Please call me at (530) 223-2585 if you have any questions or need additional information.

Sincerely,

VESTRA Resources Inc.

Wendy Johnston
Project Manager

CC: Randy McLaughlin/Old Durham Wood (randyodw@gmail.com)
Laura Shively/USACE, Sacramento (laura.b.shively@usace.army.mil)

DRAFT DELINEATION OF WATERS OF THE UNITED STATES

OLD DURHAM WOOD EXPANSION
BUTTE COUNTY, CALIFORNIA

Prepared for

Old Durham Wood

Prepared by

VESTRA Resources, Inc.

71730

FEBRUARY 2020

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TABLES

FIGURES

APPENDICES

INTRODUCTION

VESTRA conducted a delineation of Waters of the United States and aquatic resources on a portion of the property owned by Randy McLaughlin known as Old Durham Wood. A survey was conducted on January 14, 2020. The purpose of the survey was to collect data regarding the location and extent of wetlands and other waters of the United States. A Trimble Geo Explorer 6000 Series GPS Receiver was used for this delineation.

The survey involved an examination of botanical resources, soils, hydrological features, and determination of wetland characteristics based on the *United States Army Corps of Engineers Wetlands Delineation Manual* (1987); the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (2008); the *U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook* (2007); the *Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States*, (2008) and the *State of California 2016 Wetland Plant List.*

The survey area is located adjacent to the northern boundary of Old Durham Wood facility, between Oroville (Oro)-Chico Highway and State Route 99 in Butte County, California (Figures 1 and 2). The site is within the Hamlin Canyon USGS Quadrangle within Sections 21, 22 and 27, Township 21N, Range 2E. The delineation of Waters of the United States described herein this report focuses on aquatic resources that are adjacent to the northeastern boundary of the Old Durham Wood site.

Background

Previous delineation of Waters of the United States was completed by Gallaway Enterprises on the 59-acre property in compliance with the Minimum Standards for Acceptance of Aquatic Resources Delineation Reports in a Draft Wetland Delineation completed in 2013 (see Appendix A). The delineation was completed for the proposed expansion of the Old Durham Wood facility. A Preliminary Jurisdictional Determination was issued for the property by the U.S. Army Corps of Engineers on January 24, 2014 (PK-2013-01078). The Approved Jurisdictional Determination for the property was issued on June 5, 2017. These are included in Appendix A.

Prior to the facility expansion at Old Durham Wood, a ground disturbance event occurred in the summer of 2017 when California Department of Fire Protection (CALFIRE) constructed a number of fire fuel breaks across a 19-acre area of the Old Durham Wood facility in response to a wildfire event. The fuel break lines onsite are approximately 15 feet wide and range from 150 feet to one-half mile in length. Aerial imagery of the site shows that the fire breaks may have altered some of the wetland signatures that were characterized in previous wetland delineation work. Figure 3 shows the extent of changes that occurred onsite following fire suppression activities.

Old Durham Wood proposes to expand the facility boundaries into a portion of the 59-acre property that was delineated in 2013. The purpose of this Draft Wetland Delineation of WOTUS is to provide a subsequent delineation due to the impacts of fuel breaks and fire.

ENVIRONMENTAL SETTING

Currently, the area is used for cattle grazing during winter and spring. The proposed project area is composed of annual grassland habitat with lava cap occurring on the terraces and higher ridge tops within the area, which has resulted in the presence of thin soils in mound-swale topography. The vegetative community is composed of an herbaceous layer dominated by medusahead grass (*Taeniatherum caput-medusae)* and soft chess (*Bromus hordeaceus*). The project site is located on a terrace in between two drainages. Soil depth throughout the site ranges from zero to eight inches. Exposed hardpan persists within areas that contain marginal wetland characteristics. There is an elevated knoll near the approximate center of the site; water drains off of the site rapidly.

SITE SURVEY

Methodology

The 19-acre area that includes the CALFIRE fire breaks was surveyed by VESTRA staff on January 14, 2020, to identify the boundaries of any potentially jurisdictional features and status of previously mapped features. The survey, mapping efforts, and report production were performed according to the definitions of Waters of the United States (WOTUS). On October 22, 2019, the Environmental Protection Agency and Department of the Army published a final rule to repeal the 2015 Rule defining and recodify the regulatory text that existed prior to the 2015 Rule. This final rule became effective on December 23, 2019.

The boundaries of non-tidal, non-wetland waters, when present, were delineated at the ordinary high water mark (OHWM) as defined in 33 Code of Federal Regulations (CFR) 328.3. The OHWM represents the limit of United States Army Corps of Engineers (Corps) jurisdiction over non-tidal waters (e.g., streams and ponds) in the absence of adjacent wetlands (33 CFR 328.04) (Curtis, et. al. 2011). Historic aerial photographs and previous delineation reports were analyzed prior to conducting the field visit.

Wetland perimeters based on the *United States Army Corps of Engineers Wetlands Delineation Manual* (1987) and the *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Arid West Region* (2008) (Arid West Manual) were recorded and defined according to their topographic and hydrologic characterization.

Test pit sampling was performed in an area that was delineated during the previous Delineation of Waters of the United States and exhibited changes since the previous delineation due to ground disturbance. Test pit sampling involved physical sampling of soils and vegetation and investigation regarding hydrological connectivity. Photographs were taken to show wetland features, test pit areas, and/or areas identified as having historic wetland signatures. Recent disturbances to wetland features, including vernal swales, may result in a false positive in at least one of the Corps wetland indicators. This means that field tests found the occurrence of an indicator, but that indicator is not reflective of current site conditions.

Many of the terms have specific meanings relating to the federal wetland delineation process. Terms used throughout this report are defined based on the Corps *Wetlands Delineation Manual*

(1987); the Arid West Manual; *Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States, (2008)* and the Corps *Jurisdictional Determination Form Instructional Guidebook* (2007). The terms defined below have specific meaning relating to the delineation of Waters of the U.S. as described in 33 CFR Part 328 and 40 CFR Parts 110, 112, and 116, and 122.

Determination of Hydrophytic Vegetation

The presence of hydrophytic vegetation was determined using the methods outlined in the Corps *Wetlands Delineation Manual* (1987) and the Arid West Manual. Areas were considered to have positive indicators of hydrophytic vegetation if they pass the dominance test, meaning more than 50 percent of the dominant species are obligate wetland, facultative wetland, and facultative plants. Plant species were identified to the lowest taxonomy possible. Plant indicator status was determined by reviewing the State of California 2016 Wetland Plant List for the Arid West Region. In situations where dominance can be misleading due to seasonality, the prevalence index will be used to determine hydrophytic status of the community surrounding sample sites. Plant indicator status categories are defined as follows:

- *Obligate wetland plants* (OBL) – Plants that occur almost always (estimated probability 99 percent) in wetlands under normal conditions, but which may also occur rarely (estimated probability 1 percent) in non-wetlands.
- *Facultative wetland plants* (FACW) – Plants that usually occur (estimated probability 67 percent to 99 percent) in wetlands under normal conditions, but also occur (estimated probability 1 percent to 33 percent) in non-wetlands.
- *Facultative plants* (FAC) – Plants having a similar likelihood (estimated probability 33 percent to 67 percent) of occurring in both wetlands and non-wetlands.
- *Facultative upland plants* (FACU) – Plants that occur sometimes (estimated probability 1 percent to 33 percent) in wetlands, but occur more often (estimated probability 67 percent to 99 percent) in non-wetlands.
- *Obligate upland plants* (UPL) – Plants that occur rarely (estimated probability 1 percent) in wetlands, but occur almost always (estimated probability 99 percent) in non-wetlands under natural conditions.

Determination of Hydric Soils

Soil survey information was reviewed for the current site condition. Field samples were evaluated using the Munsell soil color chart (2009 Edition), hand texturing, and assessment of soil features (e.g. oxidized root channels, evidence of hardpan, Mn and Fe concretions). Information regarding local soil and series descriptions is provided in Appendix B. A test pit was installed within portions of the site that appeared to have wetland aerial signatures, contained evidence of drainage-like topography, or appeared to have been altered since the previous delineation but did not meet the wetland test parameters upon investigation in the field (Appendix C).

Determination of Wetland Hydrology

Wetland hydrology was determined to be present if a site supported one or more of the following characteristics:

- Landscape position and surface topography (e.g. position of the site relative to an up-slope water source, location within a distinct wetland drainage pattern, and concave surface topography),
- Inundation or saturation for a long duration either inferred based on field indicators or observed during repeated site visits, and
- Residual evidence of ponding or flooding resulting in field indicators such as scour marks, sediment deposits, algal matting, surface soil cracks and drift lines.
- The presence of water or saturated soil for approximately 12 percent of the growing season typically creates anaerobic conditions in the soil, and these conditions affect the types of plants that can grow and the types of soils that develop (Wetland Training Institute 1995).

Determination of Ordinary High Water Mark

VESTRA utilized methods consistent with the Arid West Manual and *Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States, (2008)* to determine the OHWM. The lateral extents of non-tidal water bodies (e.g. intermittent and ephemeral streams) were based on the OHWM, which is "the line on the shore established by the fluctuations of water" (Corps 2005). The OHWM was determined based on multiple observed physical characteristics of the area, which can include scour, multiple observed flow events (from current and historical aerial photographs), shelving, and changes in the character of soil, presence of mature vegetation, deposition, and topography. Inclusion of minor special aquatic areas is an acceptable practice as outlined in the Arid West Manual.

Jurisdictional Boundary Determination and Acreage Calculation

The wetland-upland boundary was determined based on the presence or inference of positive indicators of all mandatory criteria. Soil was assessed within wetland and upland areas. The site was traversed on foot to identify wetland features and boundaries. The spatial data obtained during the preparation of this wetland delineation was collected using a Trimble Geo Explorer 6000 Series GPS Receiver. No readings were taken with fewer than 9 satellites. Point data locations were recorded for at a rate of maximum 1 position per second. Area and line data were recorded at a rate of 1 position per second while walking at a slow pace. All GPS data were differentially corrected for maximum accuracy. In some cases, when visual errors and degrees of precision are identified due to environmental actors negatively influencing the precision of the GPS instrument (i.e. fence lines, steep topography, and other factors affecting satellite connection) mapping procedures utilized available topographic and aerial imagery datasets in order to improve accuracy in feature alignment and location.

Determination of Wetland Boundaries During a Drought

In California, the winter of 2019 was considered an above-average rainfall year (NOAA 2019). As such, the methods of delineating wetlands during drought conditions were not employed within the Property.

Determination of Wetland in Difficult Wetland Situations

Problem area wetlands are naturally occurring wetland types that lack indicators of hydrophytic vegetation, hydric soil, or wetland hydrology periodically due to normal seasonal or annual variability, or permanently due to the nature of the soils or plant species on the site. Atypical situations are wetlands in which vegetation, soil, or hydrology indicators are absent due to recent human activities or natural events.

Due to the disturbance that occurred onsite in 2017, the determination of wetlands in difficult situations was considered in areas where a change from the previous wetland delineation was evident. This area is shown as "Test Pit" on Figure 4.

Non-Jurisdictional Boundary Determination and Acreage Calculation

Areas were determined to be potentially non-jurisdictional if they did not meet the wetland test parameters or were consistent with the description of non-jurisdictional features as presented in the Corps *Jurisdictional Determination Form Instructional Guidebook* (2007). A number of areas exhibited potential wetland signatures; however, based on assessments completed at these locations, the areas lacked the necessary wetland parameters and were not mapped as features.

RESULTS

Other Waters

Photographs illustrating the current subject property conditions are included as Appendix D. Two features are identified as Other Waters of the United States within the property. Other Waters of the United States are surface water features that exhibit an OHWM but lack positive indicators for one or more of the three wetland parameters (hydrophytic vegetation, hydric soil, and wetland hydrology) (33 CFR 328.4). The boundaries of all other waters identified within the survey area were delineated based on the observed OHWM, including physical characteristics such as natural lines impressed on the bank, shelving, changes in the character of the soil, the destruction of terrestrial vegetation, debris lines and other appropriate indicators.

The other water features present within the Property have been identified as Non-Relatively Permanent Waters (NRPW). Non-Relatively Permanent Waters are defined as tributaries that flow for less than 3 months and have a documented hydrologic connection to Relatively Permanent Waters (RPW) or Traditional Navigable Waters (TNW). The NRPWs present within the Property are all unnamed tributaries of Hamlin Slough. All of the NRPWs identified within the Property contain appropriate morphology of bed, bank and scour.

The other water features present within the Property, identified as Non-Relatively Permanent Waters, were also altered by the fire break lines. The fire breaks run perpendicular to the flow of water. The berms that were created by displaced soil during fuel break installation have segmented the feature, and created isolated waters between the berms. These features were not mapped because field investigations found that they did not meet the criteria for wetland delineation.

Wetlands

Wetlands can be characterized as vernal pools, vernal swales, seasonal swales or seasonal wetlands. Pools are depressed topographic features that are formed where a shallow hardpan prevents water from draining down though the soil. Within the Property, the hardpan consisted of a cemented duripan in the fan terraces associated with the drainages or a lahar layer from historic lava flows in the terraces and higher ridge tops. Swales are low drainage pathways that typically connect to and help feed wetland or other water features. Seasonal wetlands are depressed topographic features that pond water for longer duration than vernal pools and dry during the summer months.

Three of the features identified on the Property exhibited all three of the wetland parameters. A total of three wetland features were identified within the Property including 0.029 acres of seasonal swales and 0.015 acres of seasonal pools (Figure 4).

Vegetation

Field observations of identifiable vegetation within the survey area were recorded and the plants were identified to the lowest taxonomic level possible. Plants observed onsite during the site visit and their Wetland Indicator Status are summarized in Table 1.

Table 1
PLANT SPECIES OBSERVED WITHIN THE SURVEY AREA

Scientific Name	Common Name	Wetland Indicator Status
Plagiobothrys stipitatus stipitatus	popcornflower	FACW
Avena fatua	California wild oat	UPL
Elymus caput medusae	Medusahead	UPL
Plantago erecta	Erect Plantain	UPL
Trifolium variegatum	White-tipped clover	FAC
Festuca perennis	Fescue	FAC
Hordeum murinum	Medusahead	FAC
Centaurea solstitialis	Yelllow star thistle	NL (UPL)

Legend: OBL- Obligate wetland plants have a 99% chance of occurring in wetlands; **FACW**- Facultative wetland plants have a 67% to 99% chance of occurring in wetlands; **FAC**- Facultative plants have 33-67% chance of occurring in wetlands; **FACU**- Facultative upland plants have a 1% to 33% chance of occurring in wetlands; **UPL**- Obligate upland plants have a 0% to 1% chance of occurring in wetlands. **NL**: Not Listed, assumed to be UPL.

Soils

Field observations of soil characteristics included soil color, texture, structure, and the visual assessment of soil features (e.g. the presence, or absence of redoximorphic features). Field observations of soil characteristics at the test pit sites are included in the data sheet forms presented in Appendix C. Soil texture evaluations rendered predominately loams and clay loams. The geographic region in which the property is found is often characterized as having a naturally occurring restrictive layer composed of cemented duripans and lithic and paralithic bedrock. Hardpans restrict root growth, limit water infiltration, and cause perching of the water table in certain locations.

DISCUSSION

Vernal systems are subject to a hydrological budget, such that the change in the amount of water in a pool is equal to the sum of inputs from precipitation, groundwater, and surface water, minus loss from evapotranspiration; this suggests that groundwater or surface water inputs can be negative, representing net losses to a vernal pool (Liebowitz 2008). The swale that faced disturbance from the berm and fuel breaks onsite exhibited altered hydrological connection and habitat quality, which was evident from the altered boundaries of wetland features from the previous delineation.

The previous delineation found that two seasonal swales totaling 0.275 acres occurred at the northeastern boundary of the Old Durham Wood facility (see Appendix A). This updated delineation focused on the current conditions of these seasonal swales. The current seasonal swale (0.029 acres) and pools (0.015 acres) abut the northern property boundary of Old Durham Wood. The features are restricted on the northern boundary by the roughly 6-inch tall berm that appears to be a remnant of the soil displaced during CALFIRE fire break installation (Figure 4). The current total area of these features is 0.015 acres.

REFERENCES

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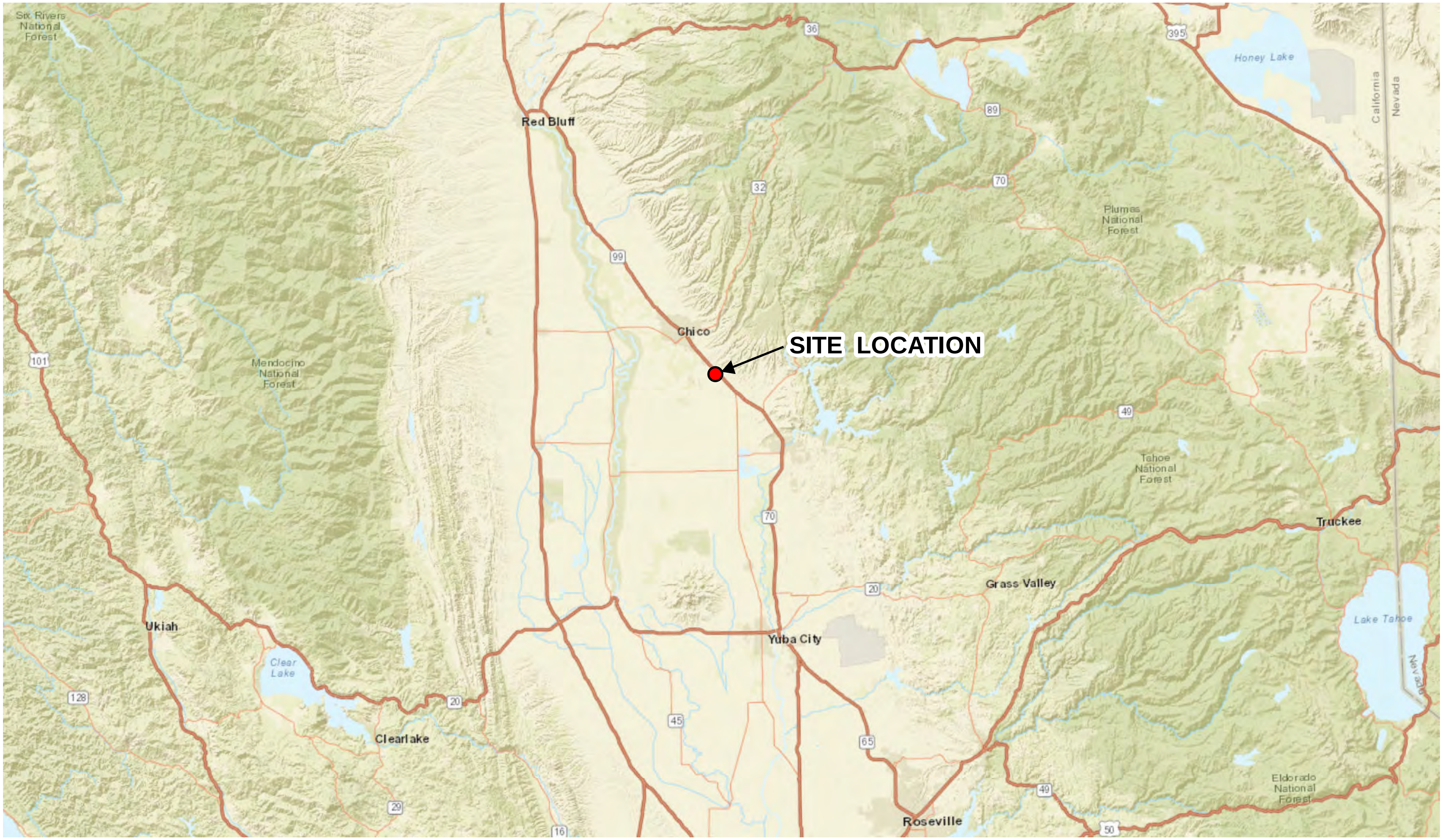


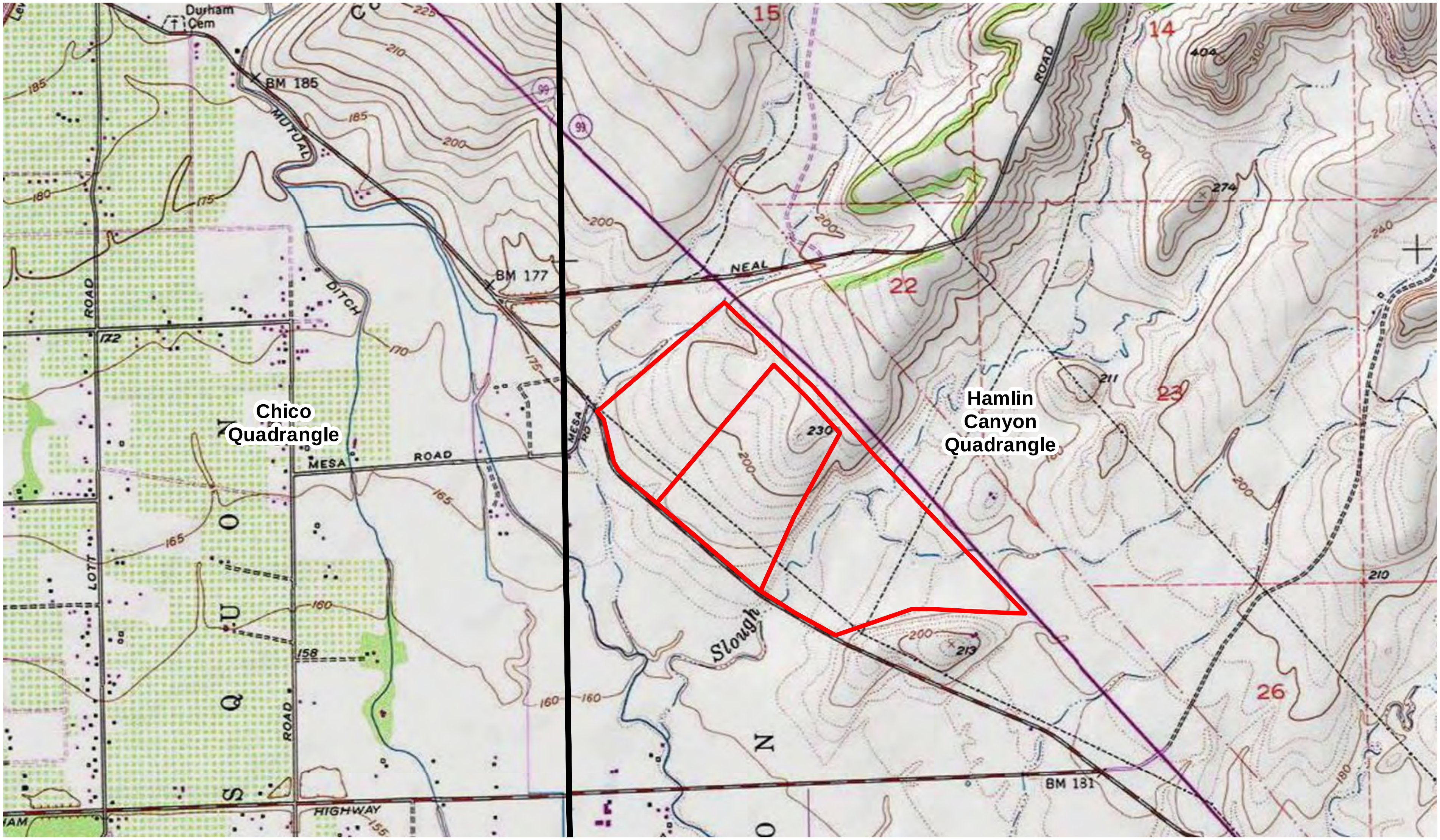
![VESTRA logo]

Miles
0 10 20 40

SOURCE: USGS NATIONAL MAP

FIGURE 1
GENERAL SITE LOCATION
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

P:\GIS\71730\Figures\WetlandDelineation\71730_GeneralSiteLocation.mxd



Approximate Site Parcel Boundary

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

SOURCE: USGS NATIONAL MAP

FIGURE 2
SITE VICINITY
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

P:\GIS\71730\Figures\WetlandDelineation\71730_SiteVicinity.mxd

Previous Wetland Feature

Seasonal Swale

Feet

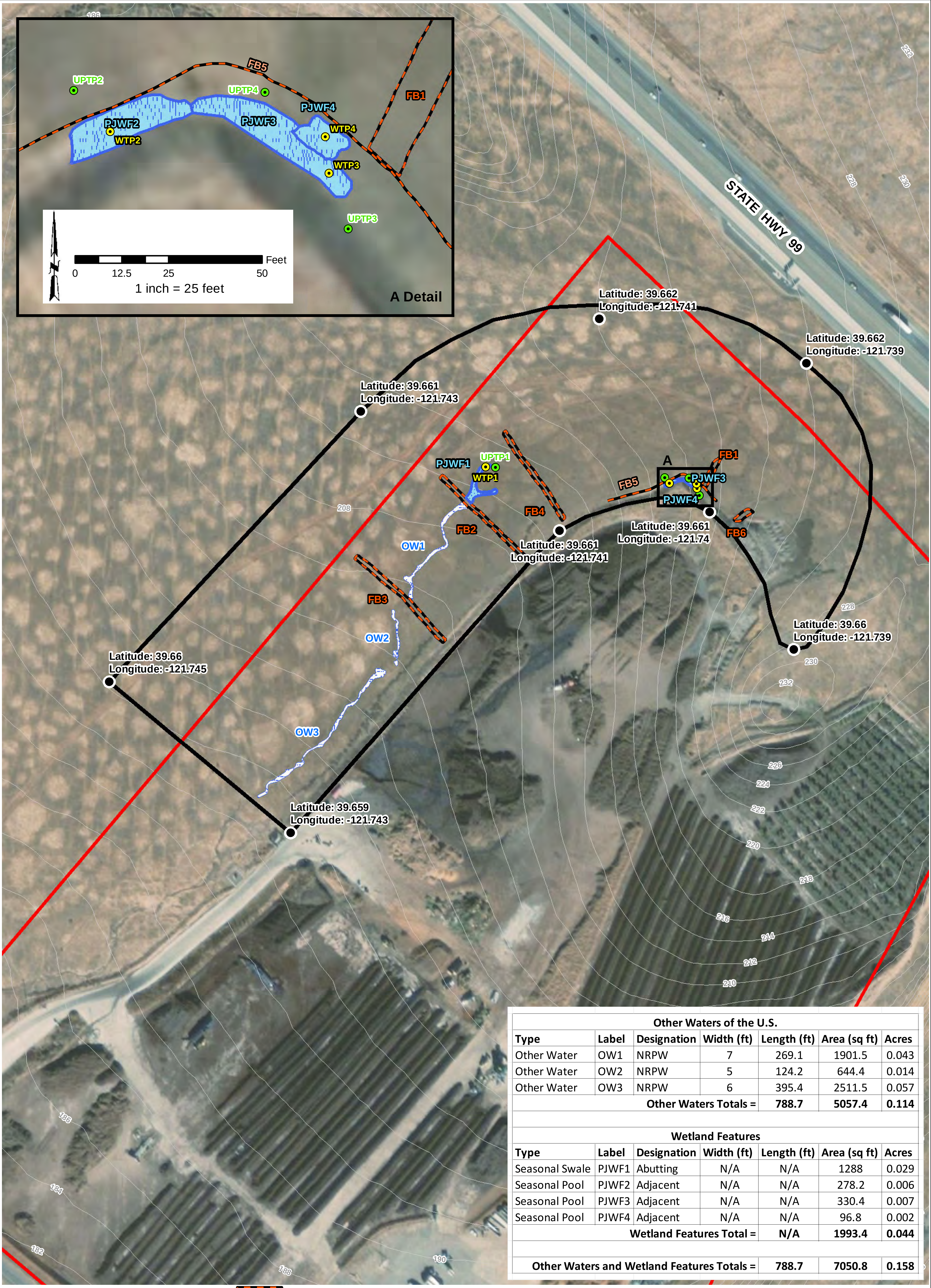
0 100 200 400

1 inch = 200 feet

SOURCE: GOOGLE EARTH OCTOBER 2017 AERIAL PHOTOGRAPH; GALLAWAY 2013

FIGURE 3
PREVIOUS WETLAND FEATURES
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

P:\GIS\71730\Figures\WetlandDelineation\71730_Previous_WD.mxd



Other Waters of the U.S.						
Type	Label	Designation	Width (ft)	Length (ft)	Area (sq ft)	Acres
Other Water	OW1	NRPW	7	269.1	1901.5	0.043
Other Water	OW2	NRPW	5	124.2	644.4	0.014
Other Water	OW3	NRPW	6	395.4	2511.5	0.057
			Other Waters Totals =	788.7	5057.4	0.114

Wetland Features						
Type	Label	Designation	Width (ft)	Length (ft)	Area (sq ft)	Acres
Seasonal Swale	PJWF1	Abutting	N/A	N/A	1288	0.029
Seasonal Pool	PJWF2	Adjacent	N/A	N/A	278.2	0.006
Seasonal Pool	PJWF3	Adjacent	N/A	N/A	330.4	0.007
Seasonal Pool	PJWF4	Adjacent	N/A	N/A	96.8	0.002
			Wetland Features Total =	N/A	1993.4	0.044
			Other Waters and Wetland Features Totals =	788.7	7050.8	0.158

Data Point

Upland Test Pit

Wetland Feature Test Pit

Control Point

Topography (2-Foot Contour)

Fuel Break (0.186 acres)

Pre-Jurisdictional Wetland Feature (0.045 acres)

Other Waters of the U.S. (0.116 acres)

Survey Area (19 acres)

Approximate Site Parcel Boundary (87 acres)

Feet
0 100 200 400
1 inch = 200 feet

Date Prepared: February 12, 2020
Prepared By: J. Williams,
VESTRA Resources, Inc.

VESTRA

SOURCE: DIGITALGLOBE 10/30/2018 AERIAL PHOTOGRAPHY

FIGURE 4
UPDATED DRAFT WETLAND DELINEATION
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

P:\GIS\71730\Figures\WetlandDelineation\71730_Updated_WD.mxd

Attachment A

Biological Assessment

BIOLOGICAL RESOURCES ASSESSMENT

OLD DURHAM WOOD SOUTH AREA
DURHAM, BUTTE COUNTY, CALIFORNIA

Prepared for

Old Durham Wood
8616 Durnel Drive
Durham, California 95938

Prepared by

VESTRA

VESTRA Resources Inc.
5300 Aviation Drive
Redding, California 96002

OCTOBER 2020

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1.0 SITE INFORMATION

The Property is located between Oroville (Oro)-Chico Highway and State Route 99, just south of Chico in Butte County, CA. The site occurs within the Hamlin Canyon USGS Quadrangle within Sections 21, 22 and 27, Township 21N, Range 2E. The general site location is shown on Figure 1.

1.1 Project Description

Old Durham Wood, Inc. (ODW) is a wood-processing facility that converts orchard wood into chips for biomass, lumber, firewood, and fines. The site has historically also received greenwaste from the City of Chico, Butte County, Paradise, and Sacramento Municipal. The wood fines generated and greenwaste received have historically been combined and composted onsite.

Old Durham Wood uses historical rice fields as a biofilter to filter stormwater from the site prior to discharge to Hamlin Slough.

A piping system is installed onsite. The proposed activity includes the reconstruction and expansion (already completed with some impacts) of the agricultural road to allow access to the stormwater outfall and filtration area for the Old Durham Wood facility.

Activities to improve a portion of the existing road have already occurred during the summer of 2020. Wetland features were impacted during the reconstruction of the existing roadway in the summer of 2020 due to a misunderstanding with the equipment operator. A portion of the existing road was extended across wetland features. A proposed site plan that shows the location of the reconstructed road and proposed road is included as Figure 2.

1.2 Conservation Measures

The following conservation measures, Best Management Practices (BMPs), and project features will be incorporated into the project in order to avoid and minimize the potential environmental impacts from completed and proposed additional roadway improvements:

- Wetland features will be avoided during future ground-disturbing road work;
- Prior to construction, high-visibility fencing, flagging, or markers will be installed along the edges of the work zone to prevent encroachment into wetland areas;
- All work and stockpiling of materials will be confined to the project disturbance area;
- Temporary stockpiling of excavated or imported material shall be placed in upland areas;
- Hazardous materials, including fuels, oils, cement, and solvents, will be stored and contained in an area protected from direct runoff and away from areas where they could enter waters of the United States;
- Vehicle fueling will be conducted a minimum of 50 feet from waters of the United States;

- Construction equipment will be inspected daily for leaks. Leaking fluids will be contained upon detection and equipment repairs will be made as soon as practicable or the leaking equipment will be moved offsite;
- Spill containment and cleanup materials shall be kept onsite at all times for use in the event of an accidental spill.

2.0 REGULATORY FRAMEWORK FOR BIOLOGICAL RESOURCES

This section describes the federal and state regulation of special-status species, waters of the United States, and other sensitive biological resources.

2.1 Federal Regulations

2.1.1 Federal Endangered Species Act

Section 9 of the federal Endangered Species Act of 1973 (ESA) prohibits acts that result in the "take" of threatened or endangered species. As defined by the federal ESA, "endangered" refers to any species that is in danger of extinction throughout all or a significant portion of its current range. The term "threatened" is applied to any species likely to become endangered within the foreseeable future throughout all or a significant portion of its current range. "Take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." Sections 7 and 10 of the federal ESA provide methods for permitting otherwise lawful actions that may result in "incidental take" of a federally listed species. Incidental take refers to take of a listed species that is incidental to, but not the primary purpose of, an otherwise lawful activity. Incidental take is permitted under Section 7 for projects on federal land or involving a federal action; Section 10 provides a process for non-federal actions. The act is administered by the U.S. Fish and Wildlife Service (USFWS) for terrestrial species.

2.1.2 Clean Water Act

The objective of the Clean Water Act (1977, as amended) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands, is regulated by the Corps under Section 404 of the Clean Water Act (33 USC 1251-1376) under a permitting process. Applicants for Section 404 permits are also required to obtain water quality certification or waiver through the local Regional Water Quality Control Board under Section 401 of the Clean Water Act (33 USC 1341).

Corps regulations implementing Section 404 define waters of the United States to include intrastate waters, including lakes, rivers, streams, wetlands, and natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce. Wetlands are defined for regulatory purposes as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3; 40 CFR 230.3). To comply with the Corps policy of "no net loss" of wetlands, discharge into wetlands must be avoided and minimized to the extent practicable. For unavoidable impacts, compensatory mitigation is typically required to replace the loss of wetland functions in the watershed.

2.1.3 Migratory Bird Treaty Act

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 CFR Part 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 CFR 21). Mitigation measures can be identified to avoid or minimize adverse effects on migratory birds.

2.2 State Regulatory Requirements

2.2.1 California Endangered Species Act

The California Endangered Species Act (CESA) lists species of plants and animals as threatened or endangered. Projects that may have adverse effects on state-listed species require formal consultation with CDFW. "Take" of protected species incidental to otherwise lawful activities may be authorized under Section 2081 of the California Fish and Game Code. Authorization from the CDFW is in the form of an Incidental Take Permit, and measures can be identified to minimize take. CDFW Species of Special Concern are considered under the California Endangered Species Act.

2.2.2 Streambed Alteration Agreement

A Lake or Streambed Alteration Agreement (Sections 1600-1616 of the California Fish and Game Code) requires an entity to notify CDFW prior to commencing any activity that may substantially obstruct the natural flow or use any material from a river, stream, or lake, or deposit or dispose of debris where it may pass into any river, stream, or lake. The notification requirement applies to any ephemeral or perennial river, stream, or lake in California.

2.2.3 Birds of Prey

Under Section 3503.5 of the California Fish and Game Code, it is unlawful to take, possess, or destroy any birds in the orders of Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird, except as otherwise provided by this code or any regulation adopted pursuant thereto. Project features will be implemented to protect nesting migratory birds and birds of prey to comply with this code.

2.2.4 Migratory Birds

The California Fish and Game Code, Section 3513, states that it is unlawful to take or possess any migratory nongame bird as designated in the MBTA or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the MBTA. Project features will be implemented to protect nesting migratory birds and birds of prey to comply with this code.

3.0 AFFECTED ENVIRONMENT

3.1 General Setting

The property was developed into rice fields in the 1960s and operated as such through 1980. Historic grading and road development exists onsite. An existing dirt road originates at the property entrance and continues around the north edge of the rice checks.

3.1.1 Climate

Precipitation primarily occurs as rain and annual rainfall is approximately 34 inches (Western Regional Climate Center 2006). Air temperatures range between an average January high of 55 degrees Fahrenheit (ºF) and an average July high of 98ºF. The year-round average high is approximately 75ºF (Western Regional Climate Center 2006).

3.1.2 Topography

The slope of the landscape is to the north, toward Hamlin Slough. The site topography terraced into engineered historical rice checks boxes have been removed or rotted over time.

3.2 Vegetation Communities

Vegetation communities in the study area were classified based on descriptions provided in A Guide to Wildlife Habitats of California (CDFW 1988), which describes typical California Wildlife Habitat Relationships (CWHR). Annual Grassland is present throughout the property. The CWHR map is included as Figure 3.

3.2.1 Annual Grassland

Annual grassland occurs in patches in the project area where tree density is relatively low and the vegetation is comprised of annual grasses and forbs. Historically, rice was cultivated onsite. The current vegetation community is natural recruitment of grasses and forbs since cultivated ceased. Having visited the parcel throughout the majority of the Annual Grassland growing season, a fairly comprehensive list of vascular plant species was obtainable. The plant list is included as Appendix A.

Plant species within upland areas include medusa grass (*Elymus caput-medusae*) (NL), hare barley (*Hordeum murinum* ssp. *leporinum*) (NL), soft chess (*Bromus hordeaceous*) (FACU), rose clover (*Trifolium hirtum*) (NL), filarees (*Erodium* spp.) (NL, FACU), fiddleneck (*Amsinckia intermedia*) (NL), Johnnytuck (*Triphysaria eriantha*) (NL), ripgut brome (*Bromus diandrus*) (NL), pepper grass (*Lepidium nitidum*) (FAC), rattail fescue (*Festuca myuros*) (NL), yellow mariposa lily (*Calochortus luteus*) (NL), old man of spring (*Senecio vulgaris*) (FACU), bur clover (*Medicago praecox*) (NL), hop clover (*Trifolium dubium*) (UPL), Fitch's spikeweed (*Centromadia fitchii*) (FACU), bicolored lupine (*Lupinus* bicolor) (NL), and others.

3.2.2 Aquatic/Riverine

Surface water onsite flows seasonally within Hamlin Slough, which is located at the northern end of the project area. Seasonal wetlands occur throughout the site as they are facilitated by historic rice checks. The wetlands identified are connected by small breaks in the rice checks. Surface water on the site drains into Hamlin Slough. Hamlin Slough is a tributary of Butte Creek, which in turn is a tributary of the Sacramento River.

Plant species within wetlands include stipitate popcorn flower (*Plagiobothrys stipitatus* var. *stipitatus*) (FACW), Fremont's goldfields (*Lasthenia fremontii*) (OBL), downingia (*Downingia bicornuta, D. cuspidata*) (OBL, OBL), coyote thistle (*Eryngiunm castrense*) (OBL), broad-leaved mudwort (*Limosella aquatic*) (OBL), manna grass (*Glyceria declinata*) (FACW), water montia (*Montia fontana*) (OBL), Sacramento mesa-mint (*Pogogyne ziziphoroides*) (OBL), Italian rye (*Lolium perenne*) (FAC), silver hair grass (*Deschampsia danthanoides*) (FACW), Mediterranean barley (*Hordeum marinum ssp. gussoneanum*) (FAC), and others.

3.3 Special-Status Biological Resources

3.3.1 Special-Status Plants

Special-status plant species include plants that are (1) designated as rare by CDFW or USFWS or are listed as threatened or endangered under the California Endangered Species Act (CESA) or ESA; (2) proposed for designation as rare or listing as threatened or endangered; (3) designated as state or federal candidate species for listing as threatened or endangered; and/or (4) ranked as California Rare Plant Rank (RPR) 1A, 1B, 2A, 2B, or 3. A list of regionally occurring special-status plant species was compiled based on a review of pertinent literature, the results of the field surveys, and a review of the USFWS species list and CNDDB and a nine-quad search (Hamlin Canyon and surrounding quads) of California Native Plant Society (CNPS) database records.

For each special-status plant species, habitat and other ecological requirements were evaluated and compared to the habitats in the study area and immediate vicinity to assess the presence of potential habitat. The habitat assessment is provided in Section 5.

3.3.2 Special-Status Animals

Special-status animal species include species that are (1) listed as threatened or endangered under the CESA or the ESA; (2) proposed for federal listing as threatened or endangered; (3) identified as state or federal candidates for listing as threatened or endangered; and/or (4) identified by the CDFW as Species of Special Concern or California Fully Protected Species.

A list of regionally occurring special-status wildlife species was compiled based on a review of pertinent literature and consultations with the USFWS Information for Planning and Consultation (iPAC) database (Appendix B) and California Natural Diversity Database (CNDDB) database records, and a query of the California Wildlife Habitats Relationship (CWHR) system.

For each special-status wildlife species, habitat and other ecological requirements were evaluated and compared to the habitats in the study area and immediate vicinity to assess the presence of potential habitat. The habitat assessment is provided in Section 5. The CNDDB query results are included as Figure 4.

4.0 BIOLOGICAL SITE SURVEY

4.1 Pre-Survey Review

Special-status plant and animal species and sensitive habitats that have the potential to occur within the project area were determined, in part, by reviewing agency databases, literature, and other relevant sources. The following information sources were reviewed to aid this determination:

- Hamlin Canyon, California, USGS 7.5-minute quadrangle;
- Aerial photography of the project area and vicinity;
- The U.S. Fish and Wildlife Service (USFWS) official list of endangered and threatened species that may occur, or be affected by projects, as provided by the Sacramento Fish and Wildlife Office (Consultation Code 08ESMF00-2020-E-03301);
- The California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife 2015a) records for the Hamlin Canyon, California USGS 7.5-minute quadrangle and the eight surrounding quadrangles;
- The California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants (California Native Plant Society 2015) records for the Hamlin Canyon, California USGS 7.5-minute quadrangle and the eight surrounding quadrangles;
- California Wildlife Habitat Relationships (CWHR) System (California Department of Fish and Game 2020).
- GIS shapefiles of designated critical habitat from the USFWS Critical Habitat Portal website;
- CDFW publications including State and Federally Listed Endangered, Threatened and Rare Plants of California (California Department of Fish and Wildlife 2015b); State and Federally Listed and Threatened Animals of California (California Department of Fish and Wildlife 2015d); and Special Animals List (California Department of Fish and Wildlife 2015e); and
- Pertinent biological literature including Bird Species of Special Concern in California (Shuford and Gardali 2008).

4.2 Survey Methods

A habitat assessment survey was completed on March 20, 2019, and September 18, 2019. The habitat assessment survey covered the entire property. A Trimble Geo XT Explorer 6000, Nikon P530 camera, and binoculars were used during the survey to observe and document site characteristics and species presence. Biological resources within these areas were documented, including all wildlife species and plant species observed during the survey.

A Wetland Delineation was completed March 19, 20, 22, 24, 30, April 4, and May 7, and 8, 2019. The draft wetland delineation is currently under review by the Army Corps of Engineers.

A rare plant survey was conducted during March for Butte County meadowfoam (*Limnanthes floccossa* ssp. *californica*), Ahart's rush (*Juncus leiospermus* var. *ahartii*), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) and Ahart's paronychia (*Paronynchia ahartii*). For the Butte County meadowfoam survey, two known populations were visited to ascertain that plants were in bloom. One population was along Bruce Road, the other near the Chico Airport.

4.3 Survey Results

The draft wetland delineation found that 26.744 acres of wetland features occur onsite. The draft wetland delineation map is included as Appendix C.

One potential special-status species was observed onsite. Several tadpole shrimp, possibly vernal pool tadpole shrimp (*Lepidurus packardi*), were observed within one of the wetland features onsite but were observed to be absent from all other wetland features. The following other wildlife species were observed during the survey:

- Northern Pacific Rattlesnake (*Crotalus oreganus oreganus*)
- Red-tailed hawk (*Buteo jamaicensis*)
- Western kingbird (*Tyrannus verticalis*)
- Western fence lizard (*Sceloporus occidentalis*)
- Fairy shrimp (*Lepidurus* sp.)

No special-status plant species were observed during the survey. A full list of plants observed in the project area is included as Appendix A.

The following plant species were the dominant plants observed within the project area:

- Medusahead (*Elymus caput-medusae*)
- Blow-wives *Achyrachaena mollis*
- Common stickyseed *Blennosperma nanum*
- Tidy tips (*Layia fremontii)*
- California goldfields (*Lasthenia californica*)
- Wild oat (*Avena fatua)*
- Rattlesnake grass (*Briza minor*)

5.0 POTENTIAL IMPACTS TO BIOLOGICAL RESOURCES

5.1 Special-Status Species

The regionally occurring species identified during the pre-survey consultation were assessed based on the potential for their habitat to occur within the project area. The habitat of each species and determination of whether the species is likely to occur in the project area is summarized in Table 1. Species that are determined to potentially occur in the project area were included in the scope of a biological resources survey.

Based on the above assessment of the presence of potential habitat for species that are known to occur in the region, the following species and communities were found to have the potential to occur onsite:

- Swainson's hawk (*Buteo swainsini*)
- Western spadefoot toad (*Spea hammondi)*
- Vernal pool tadpole shrimp (*Lepidurus packardi*)
- Conservancy fairy shrimp (*Branchinecta conservatio*)
- Vernal pool fairy shrimp (*Branchinecta lynchi*)
- Steelhead - Central Valley DPS pop. 11 (*Oncorhynchus mykiss irideus*)
- Hogwallow starfish (*Hesperevax caulescens*)
- Butte County meadowfoam (*Limnanthes floccosa* ssp. *californica*)
- Greene's tuctoria (*Tuctoria greenei*)
- Hoover's spurge (*Euphorbia hooveri*)
- Hairy Orcutt grass (*Orcuttia pilosa*)
- Veined monardella (*Monardella venosa*)
- Northern Hardpan Vernal Pool

Swainson's hawk
Buteo swainsonii
Swainson's hawks are neo-tropical migrants that winter in Mexico and South America and return to California in March to breed and rear young. Historically they inhabited open grasslands throughout most of lowland California. A variety of habitat changes, including the conversion of native grasslands through agricultural, urban, and industrial development, have caused the Swainson's hawk population to decline by more than 90 percent from levels at the time of European settlement. Swainson's hawks have become increasingly dependent on agriculture, especially alfalfa crops, as native communities are converted to agricultural lands. The diet of the Swainson's hawk in California is varied, but mainly consists of small mammals, birds, and insects (CDFW 2016).

Swainson's hawks typically nest in large, mature trees such as valley oak, cottonwood, and black walnut that are often located within the riparian areas along rivers. They forage in open grasslands, agricultural fields, and pastures. Egg incubation and juvenile rearing occurs during the spring and summer before juveniles fledge. Alfalfa, row crops, grain fields, and irrigated pastures are the Swainson's hawk's preferred foraging habitats, where they take advantage of the opportunities that harvesting and irrigating practices provide for the easy capture of small rodents. They do not typically forage in vineyards, orchards, or flooded rice fields because prey is not accessible (Estep 1989).

Table 1 POTENTIALLY OCCURRING SPECIAL-STATUS SPECIES				
Common Name	**Scientific Name**	**Conservation Status**	**Habitat**	**Potential to Occur**
BIRDS				
American peregrine falcon	*Falco peregrinus anatum*	Federal: Delisted State: Endangered CDFW: Fully Protected USFWS: Birds of Conservation Concern	Riparian corridors with large trees, forage over open water	No
Burrowing owl	*Athene cunicularia*	CDFW: Species of Special Concern	Grassland, prairies with bare ground, friable soils enable burrowing	No, lava cap and clay soils prevent burrowing
Swainson's hawk	*Buteo swainsini*	State: Threatened	Large, open grasslands in riparian systems, known to forage in agricultural fields	Yes, foraging habitat onsite
MAMMALS				
Western mastiff bat	*Eumops perotis californicus*	CDFW: Species of Special Concern	Roost in crevices in vertical rock outcrops and tall buildings (needs vertical faces to take flight)	No
North American porcupine	*Erethizon dorsatum*	CDFW: Species of Special Concern	Montane conifer and wet meadows	No
REPTILES & AMPHIBIANS				
Western spadefoot toad	*Spea hammondi*	CDFW Species of Special Concern	Vernal pools and isolated pools in Cismontane woodland, valley and foothill grassland	Yes
Giant gartersnake	*Thanophis gigas*	Federal: Threatened	Agricultural wetlands such as irrigation and drainage canals, low gradient streams, marshes ponds, sloughs, small lakes.	No
Western pond turtle	*Emys marmorata*	CDFW: Species of Special Concern	Aquatic, marsh & swamp, ponds and wetland habitat with basking sites and refugia	No
California red-legged frog	*Rana draytonii*	Federal: Threatened	Perennial slow moving waters; ponds, lakes	No
Foothill yellow-legged frog	*Rana boylii*	CDFW: Species of Special Concern	Fast-moving, rocky streams and rivers with sunny banks in forests and chaparral	No
INVERTEBRATES				
Vernal pool tadpole shrimp	*Lepidurus packardi*	Federal: Endangered	Northern Hardpan vernal pool; Critical Habitat in Butte County*	Yes
Conservancy fairy shrimp	*Branchinecta conservatio*	Federal: Endangered	Northern Hardpan Vernal pool	Yes
Vernal pool fairy shrimp	*Branchinecta lynchi*	Federal: Threatened	Northern Hardpan Vernal pool	Yes
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	Federal: Threatened	Riparian scrub, Elderberry shrubs	No

Table 1 **POTENTIALLY OCCURRING SPECIAL-STATUS SPECIES**				
Common Name	**Scientific Name**	**Conservation Status**	**Habitat**	**Potential to Occur**
FISH				
Steelhead - Central Valley DPS pop. 11	*Oncorhynchus mykiss irideus*	Federal: Threatened	Aquatic; Rivers and perennial and intermittent tributaries	Yes, possible migration route
Chinook salmon - Central Valley spring-run ESU pop. 6	*Oncorhynchus tshawytscha*	Federal: Threatened State: Threatened	Aquatic; Rivers and perennial and intermittent tributaries	No
Delta smelt	*Hypomesus transpacificus*	Federal: Threatened	Sacramento-San Joaquin Estuary	No
PLANTS				
Veined monardella	*Monardella venosa*	CRPR: 1B.1	Valley grassland (BP: June-July)	Yes
Greene's tuctoria	*Tuctoria greenei*	Federal: Endangered CRPR: 1B.1	Vernal pools. (BP: May - September)	Yes
Hoover's spurge	*Euphorbia hooveri*	Federal: Threatened CRPR: 1B.2	Vernal pools (BP: July-September)	Yes
Hairy Orcutt grass	*Orcuttia pilosa*	Federal: Endangered State: Endangered CRPR: 1B.1	Deep vernal pools (BP: May-September)	Yes
Hogwallow starfish	*Hesperevax caulescens*	CRPR: 4.2	Deep vernal pools	Yes
Butte County meadowfoam	*Limnanthes floccosa* ssp. *californica*	Federal: Endangered State: Endangered CRPR: 1B.1	Annual grasslands and vernal pools. (BP: March - May)	No – species not observed during protocol-level survey
Ahart's dwarf rush	*Juncus leiospermus* var. *ahartii*	CRPR: 1B.2	Vernal pool margins, grassland	No – species not observed during protocol-level survey
Red Bluff dwarf rush	*Juncus leiospermus* var. *leiospermus*	CRPR: 1B.1	Vernally mesic areas in chaparral, valley and foothill grassland, vernal pools	No – species not observed during protocol-level survey
Ahart's paronychia	*Paronychia ahartii*	CRPR: 1B.1	Cismontane woodland, valley & foothill grassland, vernal pool, wetland	No – species not observed during protocol-level survey
Pink creamsacs	*Castilleja rubicundula* var. *rubicundula*	CRPR: 1B.2	Chaparral, cismontane woodland, meadows and seeps, valley and foothill grassland (serpentine)(BP: April-June)	No
Slender-leaved pondweed	*Stuckenia filiformis* ssp. *alpina*	CRPR: 2B.2	Freshwater Wetlands, wetland-riparian (BP: May-June)	No
Butte County checkerbloom	*Sidalcea robusta*	CRPR: 1B.2	Dry banks in chaparral/blue-oak woodland transition; chaparral (BP: April-June)	No

Table 1 POTENTIALLY OCCURRING SPECIAL-STATUS SPECIES				
Common Name	**Scientific Name**	**Conservation Status**	**Habitat**	**Potential to Occur**
Butte County fritillary	*Fritillaria eastwoodiae*	CRPR: 3.2	Chaparral, cismontane woodland, openings in lower montane coniferous forests, sometimes serpentinite (BP: March-June)	No
Woolly rose-mallow	*Hibiscus lasiocarpos* var. *occidentalis*	CRPR: 1B.2	Marshes and swamps (freshwater) (BP: June-September)	No
Big-scale balsamroot	*Balsamorhiza macrolepis*	CRPR: 1B.2	Chaparral, ultramafic soils (BP: March-June)	No
Northern Hardpan Vernal Pool	--	S3.1	--	Yes
Great Valley Cottonwood Riparian Forest	--	S2.1	--	No
Great Valley Mixed Riparian Forest	--	S2.2	--	No
Great Valley Valley Oak Riparian Forest	--	S1.1	--	No
Fed T: federally listed as threatened; **Fed E**: federally listed as endangered; **Fed C**: Candidate for listing; **State T**: state listed as threatened **State E:** state listed as endangered; **CDFW SSC**: Species of Special Concern; **CDFW FP**: CDFW fully protected; **CDFW WL**: CDFW watch list; **1B:** Plants rare, threatened, or endangered in California and elsewhere**; 2B**: Plants rare, threatened, or endangered in California but more common elsewhere. *Critical habitat as listed by the US Fish and Wildlife Service				

The project area may provide foraging opportunities since the area is comprised of annual grassland that is inhabited by prey species such as ground squirrels, fence lizards, and smaller birds. Temporary noise increases and human presence from the proposed road work are not likely to deter foraging Swainson's hawks because heavy equipment is commonly used at the Old Durham Wood site, adjacent to the project area. Additionally, the proposed road work occupies a small portion of the property such that foraging opportunities will remain in the surrounding area. The road work will not cause removal or degradation of foraging habitat onsite; therefore, the project will not result in impacts to Swainson's hawks or their foraging habitat onsite. The project will have no impact on Swainson's hawks.

Western Spadefoot Toad
Spea hammondi
Western spadefoot habitat includes grasslands, oak woodlands, and chaparral where pools exist. Western spadefoot toads most frequently inhabit temporary pools such as vernal pools and pools that form following a disturbance, although they occasionally breed in isolated pools near intermittent streams where larvae develop as the streams dry. In order to support metamorphosis, breeding pools must remain filled long enough to accommodate the larval period, which is typically about thirty days. Western spadefoot toads can construct burrows 10 centimeters to 90 centimeters deep in hard dry soil to avoid desiccation during hot, dry summer months. This species occurs mostly below 900 meters (3000 feet) in elevation (Stebbins 1985). The average elevation of sites where the species still occurs is significantly higher than the

average elevation for historical sites, suggesting that declines have been more pronounced in lowlands (USFWS 2005).

According to the CNDDB, the project site lies within "low quality habitat" for the western spadefoot toad (Gogol-Prokurat 2016). Therefore, the potential for habitat to occur onsite was considered during the assessment. The nearest record to the project area is approximately six miles southeast in Dry Creek. There are no documented occurrences within the Hamlin Slough Watershed (CNDDB 2020). There are no occurrences anywhere west of State Route 99. This is likely due to the prevalent agricultural practices, urbanization, and other development that reduced suitable habitat for western spadefoot toads and other vernal pool grassland species in low elevation areas in Butte County (Shedd 2016). While Old Durham Wood has faced historic land conversion from wetlands to rice fields, the current wetland features onsite may provide habitat for the western spadefoot toad. Some of these features were impacted during road enhancement work completed in 2020.

The presence of western spadefoot toads in the project area has not been determined through surveys. None have been observed onsite during many wet season site visits that have occurred since 2017. Because this species spend much of their life underground, the lack of observations cannot confidently rule out the species' presence. The work conducted in the summer of 2020 impacted vernal pool habitat. The proposed future road will avoid wetland features and will take place during a time of year when upland migration is unlikely to occur. Surveys for western spadefoot toads should occur prior to proposed future road construction.

Vernal pool tadpole shrimp
Lepidurus packardi
Vernal pool tadpole shrimp are small crustaceans in the Triopsidae family and are federally listed as endangered. Their diet consists of organic debris and living organisms, such as fairy shrimp and other invertebrates. They inhabit vernal pools containing clear to highly turbid water. The vernal pool tadpole shrimp is known from 18 populations in the Central Valley, ranging from east of Redding in Shasta County south to the San Luis National Wildlife Refuge in Merced County, and from a single vernal pool complex on the San Francisco Bay National Wildlife Refuge in the City of Fremont, Alameda County. Critical habitat has been designated by the USFWS as covering the project area (Appendix D).

Due to the habitat onsite and the proximity of the project site to Critical Habitat, there is potential for this species to occur onsite. Vernal habitat was impacted during road enhancement work completed in 2020; however, the future road will avoid wetland features.

Conservancy fairy shrimp
Branchinecta conservatio
Conservancy fairy shrimp are endemic to vernal pools in California, and this species is restricted to the Central Valley except for one population along the Central Coast in Ventura County. The majority of sites inhabited by the Conservancy fairy shrimp are relatively large and turbid vernal pools, often referred to as playa pools (Vollmar 2002). Playa pools often remain inundated much longer than typical vernal pools, in some cases well into the summer, and can be identified by their large size (typically greater than 60 meters in diameter) (Vollmar 2002).

The Vina Plains population is comprised of five localities within a 1-mile area and three additional localities within 5 miles. There are four known localities within the Nature Conservancy's Vina Plains Preserve (CNDDB 2020). Localities outside of the Vina Plains Preserve include the Laniger Lakes locality, Tehama County, two localities along State Route (SR) 99 in Butte County, just south of the Tehama County line, along Keefer Road, east of SR 99, the Neary Parcel, just east of SR 99 and south of Vina Plains in Tehama County, and Meridian Ranch Conservation Bank, approximately 1.5 miles east of the SR 99 localities (USFWS 2012).

Due to the vernal pool habitat onsite and proximity to known populations of this species, there is potential habitat onsite; however, this species is extremely endemic and the nearest documented occurrence is approximately 14 miles north of the project area near the Chico Municipal Airport (CNDDB 2020). Therefore, it is unlikely that this species has recruited to the project area.

Vernal pool fairy shrimp
Branchinecta lynchi
Vernal pool fairy shrimp are federally listed as threatened and are widespread, but not abundant. Known populations extend from Stillwater Plains in Shasta County through most of the length of the Central Valley to Tulare County. Along the central coast, they range from northern Solano County to Pinnacles National Monument in San Benito County. The vernal pool fairy shrimp occupies a variety of different vernal pool habitats, from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools. Although the species has been collected from large vernal pools including one exceeding 25 acres, it tends to occur in smaller pools. It is most frequently found in pools measuring less than 0.05 acre. These are most commonly in grass or mud bottomed swales, or basalt flow depression pools in unplowed grasslands.

Due to the vernal pool habitat onsite and proximity to known populations of this species, there is potential for this species to occur onsite. Vernal pool habitat was impacted during road enhancement work completed in 2020. The future proposed road will avoid wetland features. Therefore, impacts to conservancy fairy shrimp should not occur during proposed future road construction.

Steelhead - Central Valley DPS pop. 11
Oncorhynchus mykiss irideus
The Central Valley steelhead DPS was once widespread throughout the Central Valley. No reliable estimates of historical Central Valley steelhead population size currently exist. Based on monitoring below the confluence of the Sacramento and San Joaquin rivers at Chipps Island in 1997 to 1999 and calculations reported in Good et al. (2005) using generous assumptions, roughly 100,000 to 300,000 steelhead juveniles are produced naturally each year in the Central Valley. In the 1950s, the average estimated spawning population size above the mouth of the Feather River in the Sacramento River system was 20,540 fish (McEwan and Jackson 1996). In 1991-1992, the annual run size for the total Sacramento River system was likely less than 10,000 adult fish.

The population numbers returning have decreased substantially since 1966. In the late 1960s, roughly 20,000 fish passed through the fish ladders; in 1994, only 2,000 returned. These statistics include hatchery fish from Coleman National Fish Hatchery.

The present distribution of Central Valley steelhead is greatly reduced from their historical range, mostly due to impassible dams that block access to spawning and rearing habitat. Naturally spawning populations that support anadromy have been found in the upper Sacramento River and tributaries, Mill, Deer, and Butte creeks, and the Feather, Yuba, Mokelumne, Calaveras, and Stanislaus rivers (Butte County Regional Conservation Plan 2019).

According to the University of California, Davis PISCES Database, anadromous fish have historically inhabited the Hamlin Slough Watershed (HUC-12 180201580203) (Santos 2014). There are no known dams or other obstructions to anadromous fish passage downstream from the Old Durham Wood facility; however, the slough is poorly defined and is engineered in some areas. Therefore, it is unlikely that steelhead migrate along Hamlin Slough to the upper reaches of the watershed near Paradise, California. Due to the lava cap which covers the area, the substrate of the slough is bedrock. The project area does not provide the substrate that is required for egg deposition and fry development.

The proposed future road construction will not impact Hamlin Slough and impact to Central Valley steelhead is unlikely.

Hogwallow starfish
Hesperevax caulescens
This species is known from 20 counties in California, including Amador, Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kern, Merced, Monterey, Napa, Sacramento, San Diego, San Joaquin, San Luis Obispo, Solano, Stanislaus, Sutter, Tehama and Yolo. CNPS lists a total of 13 USGS quadrangles from which it is recorded. The species has been assigned a CNPS Rank of 4.2, which means it is uncommon in California and is fairly endangered. It has been assigned a State Rank of S3 and Global Rank of G3, meaning it is "Vulnerable." Hogwallow starfish is threatened by development, agriculture, and possible overgrazing.

During the site plant survey completed in the spring 2019, hogwallow starfish (*Hesperevax caulescens*), was locally sparse to abundant approximately in the middle of the parcel in the vicinity of the western end of the proposed project area. The area where the species was present was not impacted by the wetlands filling during the 2020 construction and can be avoided with the future road construction. This area is outside of the proposed new road route. No impacts to starfish hogwallow are likely to occur.

Butte County meadowfoam
Limnanthes floccosa* ssp. *californica
Butte County meadowfoam (BCM) is an annual herb that is endemic to California's Central Valley. This species occurs within a narrow approximately 30-mile strip along the eastern margin of the Sacramento Valley from central Butte County to near the northern border of Butte County at elevations from 150 to 2800 feet (CNPS 2020). USFWS Critical Habitat for this species has been designated from southern Tehama County to Chico, California, and another patch is designated between State Route 149 and State Route 99, north of the Thermalito Forebay. BCM occurs in grassland areas with vernal swales, vernal pools with flashy hydrology,

and secondarily along the margins of vernal pools with more persistent hydrology. Seed dormancy accounts for fluctuations in populations from year to year.

A survey completed in March 2019 for Butte County meadowfoam found that, although potential habitat occurs onsite, the plant was not growing on the property. No impacts are anticipated for this species.

Greene's tuctoria
Tuctoria greenei
Tuctoria greenei is currently found in widely separated occurrences in Butte, Merced, Shasta and Tehama Counties. Sixty percent of the extant occurrences are in the Vina Plains area of Tehama and Butte Counties. Eastern Merced County has about 30 percent of the known occurrences. Other occurrences are located in Glenn and Shasta Counties. The species seems to have been extirpated from Fresno, Madera, San Joaquin, Stanislaus, and Tulare counties.

The species has been found in three types of vernal pools: Northern Basalt Flow, Northern Claypan and Northern Hardpan, on both low and high terraces. Occupied pools are or were underlain by iron-silica cemented hardpan, tuffaceous alluvium or claypan. Of pools where the species was known to be extant in 1987, the median size was 0.6 hectare (1.5 acres), with a range of 50 square meters (0.01 acre) to 3.4 hectares (8.4 acres) (USFWS 2009). This species was not found onsite during the 2019 surveys.

There is potential habitat for this species onsite. Vernal pool habitat was impacted during road enhancement work in 2020. Future activities will avoid vernal pool habitat onsite.

Hoover's spurge
Euphorbia hooveri
This species occurs exclusively in vernal pools; however, the plant appears to be adapted to a wide variety of soils, which range in II-15 texture from clay to sandy loam. Natural pools in which the plant occurs are primarily classified as Northern Hardpan and Northern Claypan vernal pools (Sawyer and Keeler-Wolf 1995). In the Northeastern Sacramento Valley Vernal Pool Region, occupied pools are generally on acidic soils over iron-silica cemented hardpan.

The pools supporting this species vary in size from 0.19 to 243 hectares (0.47 to 600 acres), with a median area of 0.58 hectare (1.43 acres) (Stone et al. 1988). This species may occur along the margins or in the deepest portions of the dried pool-bed (Stone et al. 1988, Alexander and Schlising 1997). Deeper pools apparently provide better habitat for this species because the duration of inundation is longer and the deeper portions are nearly devoid of other vegetation, thus limiting competition from other plants. This species was not identified onsite during the 2019 surveys.

There is potential for Hoover's spurge to occur in the relatively deep pools onsite. Vernal pool habitat was impacted during road enhancement work in 2020. Future work activities will avoid vernal pool habitat onsite.

Hairy Orcutt grass
Orcuttia pilosa
The remaining known extant occurrences of hairy orcutt grass occur in two areas: Glenn and Tehama Counties in the north, and Madera and Stanislaus counties farther to the south. Within about the last decade, 10 new natural occurrences of hairy Orcutt grass have been discovered: 5 in Madera County, 4 in Tehama County, and 1 in Stanislaus County (CNDDB 2005). Primary reasons for decline or limitation of population persistence are agricultural development, urban development, cattle grazing, and invasive species competition.

This species is found on high or low stream terraces and alluvial fans in Northern Basalt Flow, Northern Claypan, and Northern Hardpan vernal pools within annual grasslands (Butte County Regional Conservation Plan 2019). The median size of occupied pools measured in the late 1980s was 4.2 acres, with a range of 0.8 to 617.5 acres (USFWS).

This species is not anticipated to occur onsite. The wetland features onsite do not meet the size requirements that have been documented for hairy Orcutt grass. Additionally, historic cattle grazing and the prior conversion to agricultural field (rice checks) have likely prevented any establishment of a viable population onsite. Therefore, no impacts to hairy Orcutt grass are anticipated.

Veined Monardella
Monardella venosa
The veined monardella is a California endemic, currently known from two extant populations. One occurrence is in central Butte County, located on private property, and the other is in Tuolumne County, on private land near the Peoria Basin (Butte County HCP 2012). The extant occurrence in Butte County occurs within the Plan Area on private property south of Chico near Neal Road. The population is found scattered among six small sites, containing from fewer than 10 to over 1,000 plants each within a 60-hectare area in two separate but 18 interconnected canyons within upper Hamlin Canyon (CNDDB 2020). From the known extant occurrences, the veined monardella's elevation range is most likely 270 feet (82.3 meters) in Butte County to 860 feet (262 meters) in Tuolumne County (CNDDB 2007).

Although this species is documented upslope from the project area within the Hamlin Slough canyon, the project area is below the known elevation range for the extant populations of veined monardella. Therefore, this species is not likely to occur onsite.

Northern Hardpan Vernal Pool
Vernal pools form where a soil layer exists below or at the surface that is impermeable or nearly impermeable to water (Smith and Verrill 1998). Sawyer and Keeler-Wolf (1995) classified California vernal pools as Northern Hardpan, Northern Claypan, Northern Basalt Flow, Northern Volcanic Mudflow, and Northern Volcanic Ashflow based on the various types of impermeable layers.

Northern Hardpan vernal pools are formed on alluvial terraces with silicate-cement soil layers. These pool types are on acidic soils and can exhibit well-developed mima mound topography found on the eastern margins of the Central Valley. These systems are shallow ephemeral water bodies found in depressions (up to several acres in size) among grasslands and open woodlands throughout the northern Central Valley of California. The northern hardpan layers are formed on alluvial terraces by leaching, redeposition, and cementing of silica minerals from high in the soil profile to a lower ("B") horizon (Smith and Verrill 1998).

In addition to hosting several federally and California listed plant and invertebrate species, the Northern Hardpan Vernal Pool habitat is listed as a state rarity rank of 3.1, which if defined as "*Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.*" Communities with ranks of S1-S3 are considered Sensitive Natural Communities to be addressed in the environmental review processes of CEQA and its equivalents.

Vernal pool habitat was impacted during road enhancement work in 2020; however, future activities will avoid impacts to vernal pool habitat onsite.

5.2 Critical Habitats

The project site is located near the US Fish and Wildlife Service-designated critical habitat for Vernal Pool Tadpole Shrimp (see Appendix D) and Butte County meadowfoam (see Appendix E). Potential project impacts to these critical habitats are discussed in Section 5.1.

The project site is not located within any National Marine Fisheries Service-designated critical habitats.

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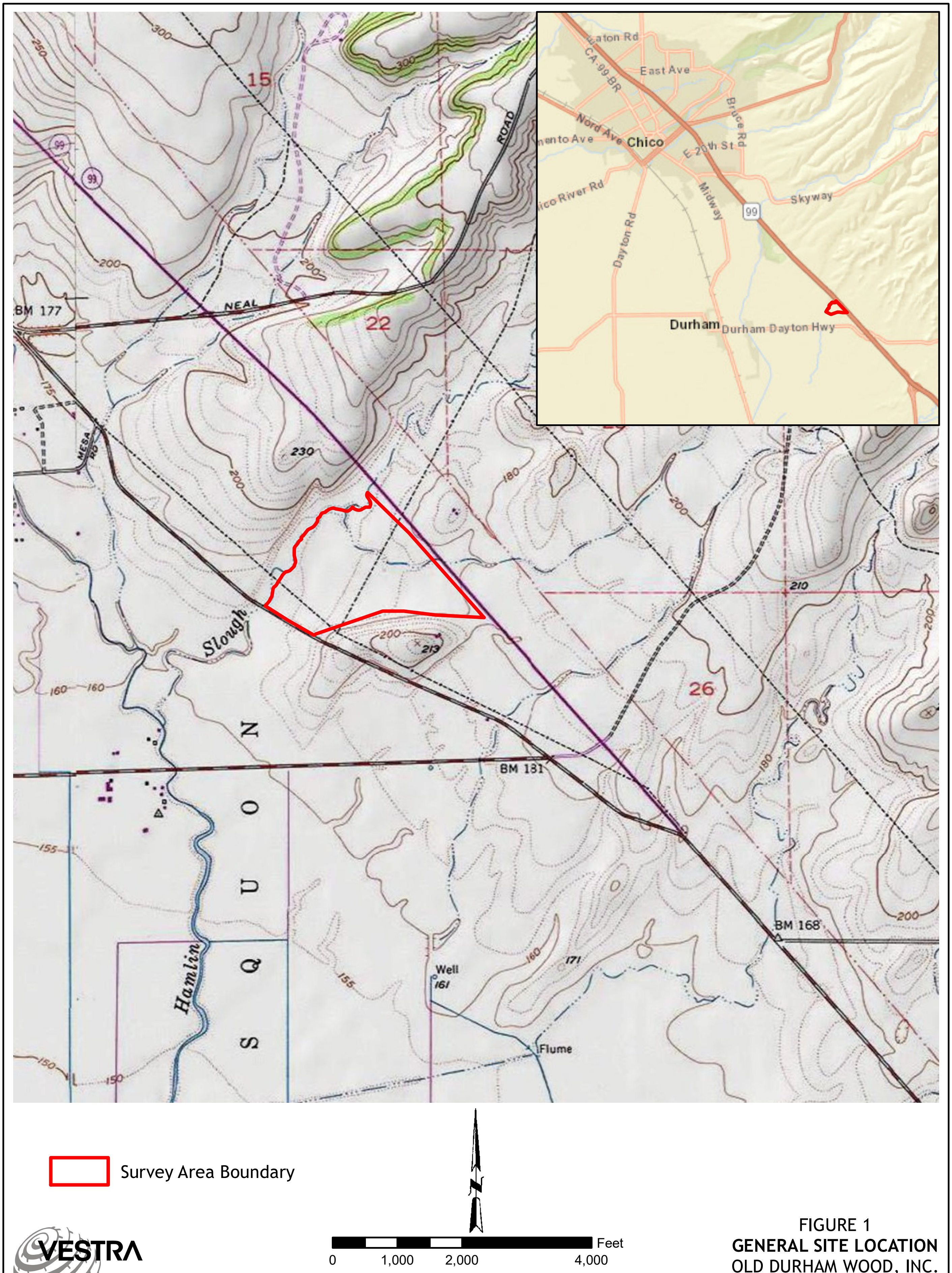

FIGURE 1
GENERAL SITE LOCATION
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

VESTRA

SOURCE: USGS 7.5' TOPOGRAPHIC MAP, HAMLIN CANYON QUADRANGLE

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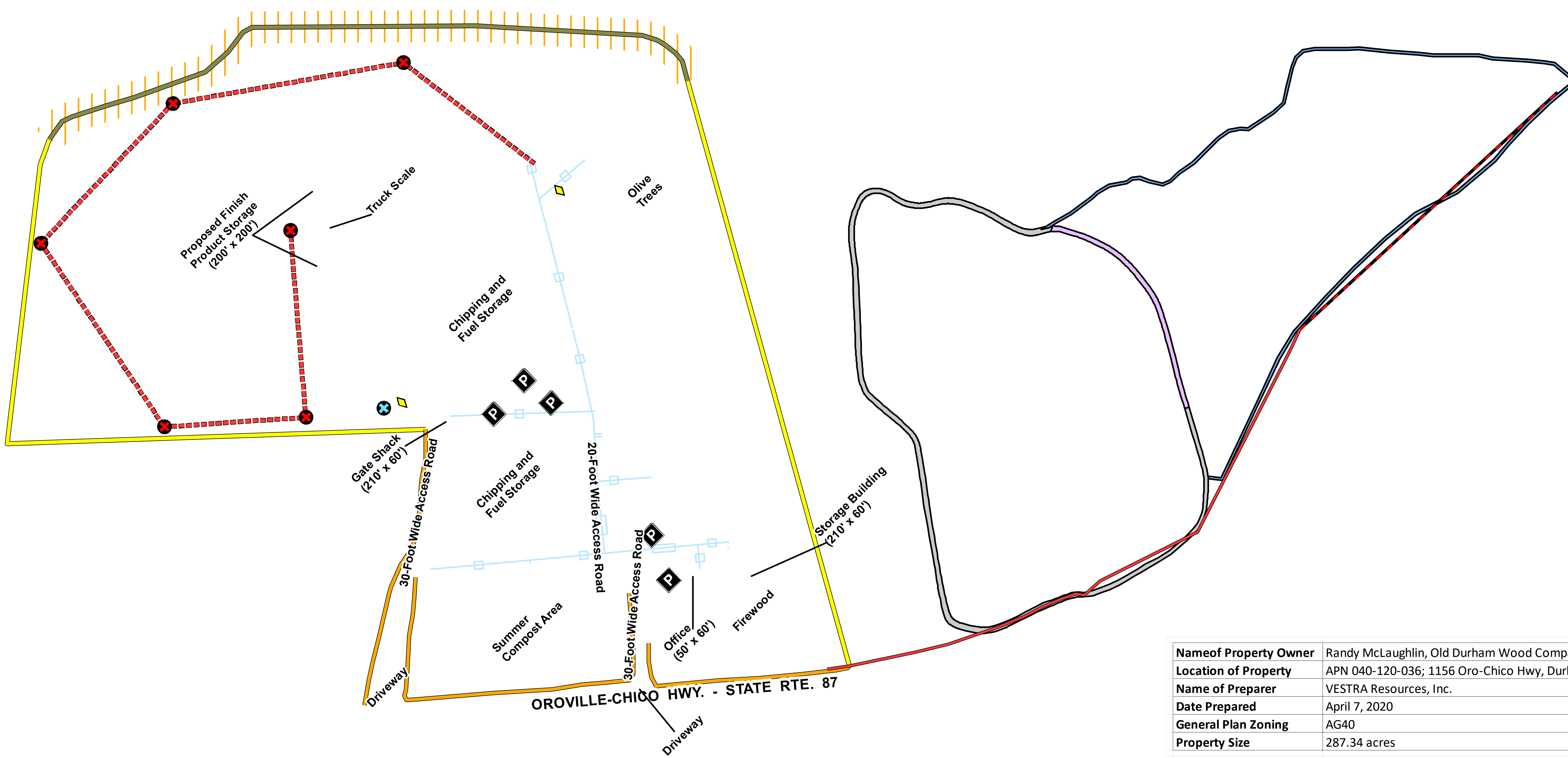

Nameof Property Owner	Randy McLaughlin, Old Durham Wood Company
Location of Property	APN 040-120-036; 1156 Oro-Chico Hwy, Durham, CA
Name of Preparer	VESTRA Resources, Inc.
Date Prepared	April 7, 2020
General Plan Zoning	AG40
Property Size	287.34 acres

Proposed Septic
Proposed Fire Hydrant
Proposed Well
Parking
Stormwater Pipeline
Proposed Expansion of Stormwater Pipeline
Berm
Proposed Outside Border Berm
Proposed Outside Grazing Berm
Proposed Fire Water System Pipes
Fire System Water Pipes
Proposed Road
New Road
Reconstructed Road
Proposed Building
Proposed Access Road
Detention Pond
Rocked Access Corridor
Buildings
Approximate Parcel Boundary

Feet
0 200 400 800
1 inch = 400 feet

VESTRA

SOURCE: DIGITALGLOBE 2018 AERIAL PHOTOGRAPH

FIGURE 2
PROPOSED SITE PLAN
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

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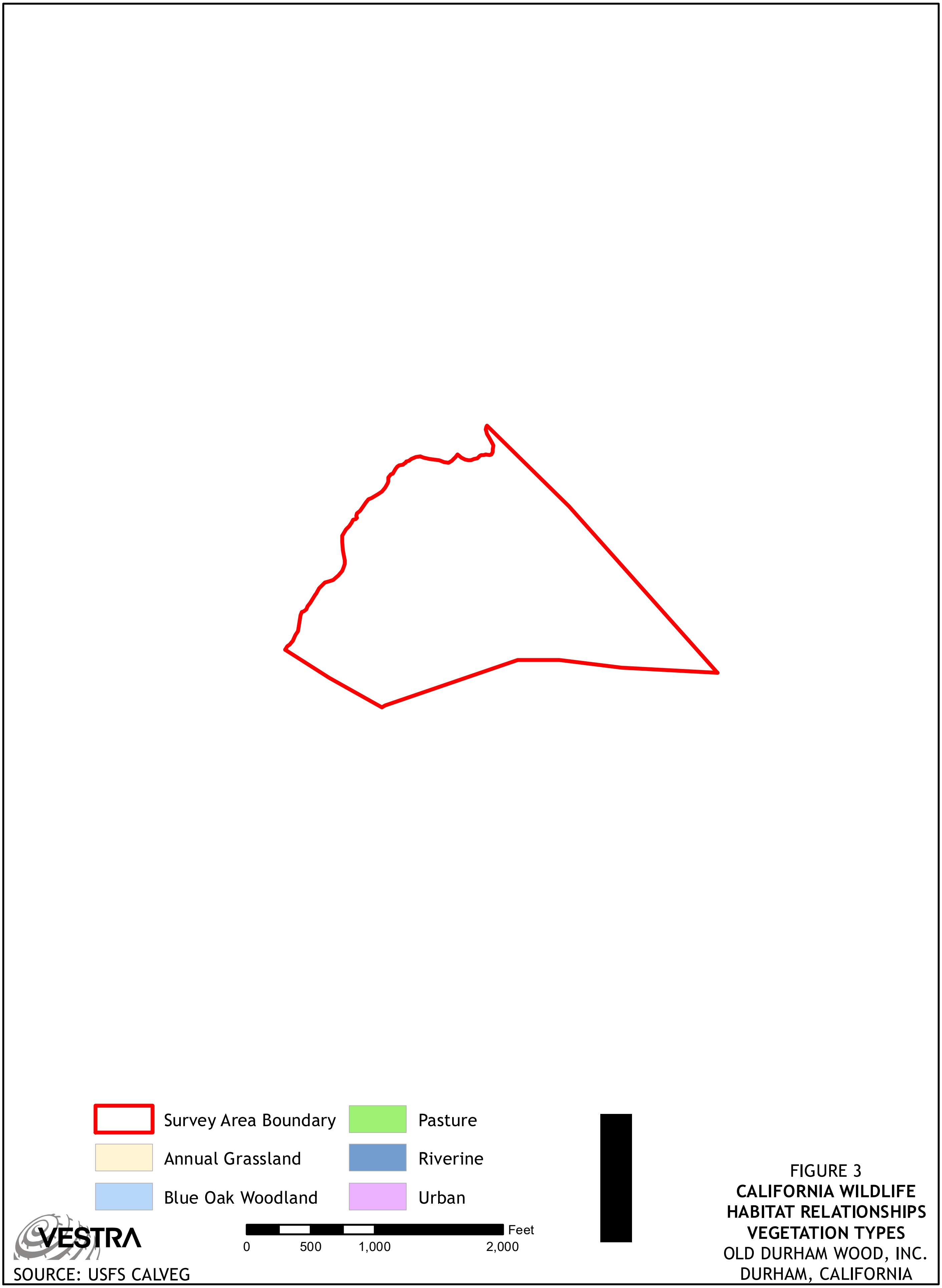

FIGURE 3
CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS VEGETATION TYPES
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

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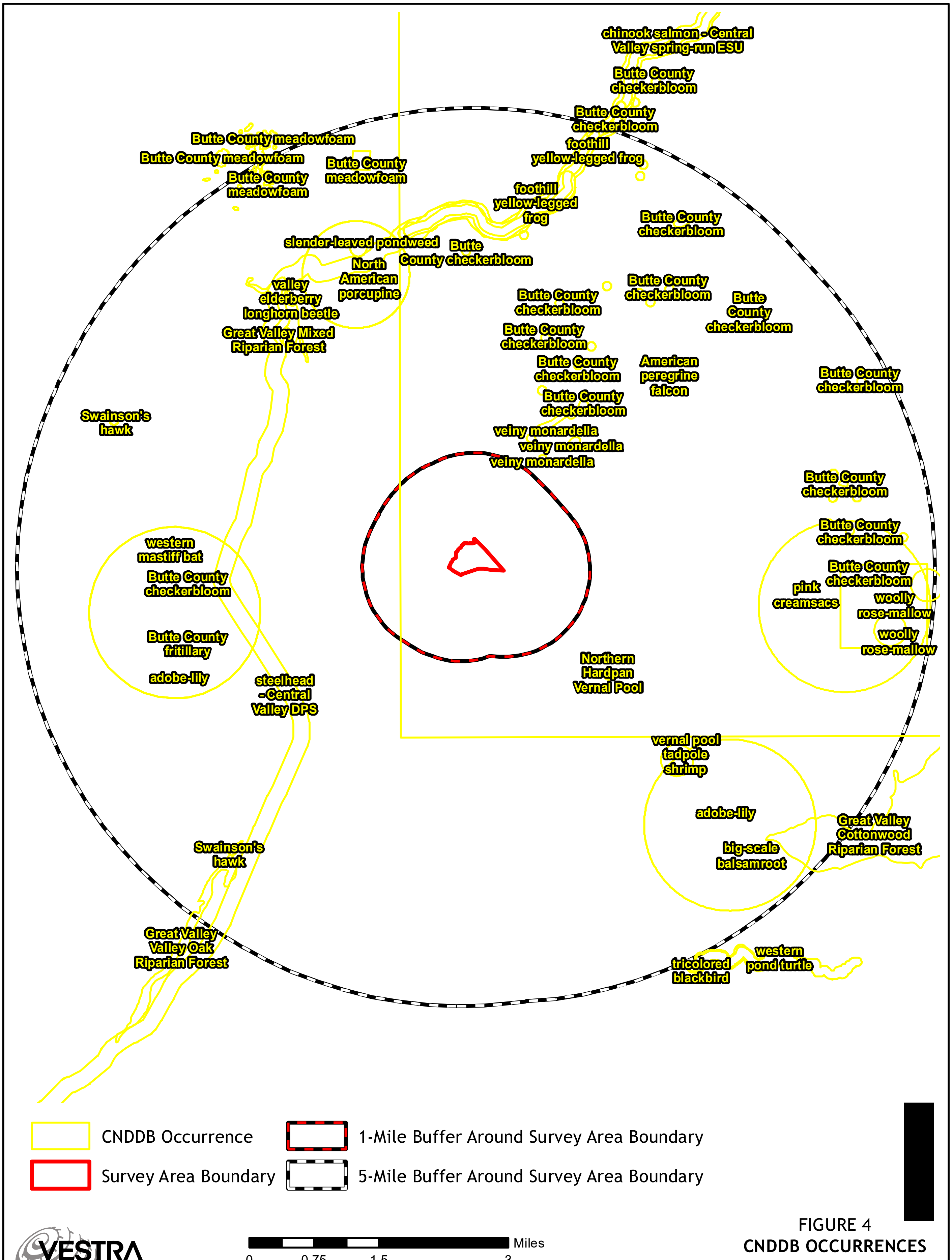

VESTRA

SOURCE: CDFW CNDDB SEPTEMBER 2020

FIGURE 4
CNDDB OCCURRENCES
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

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Appendix A

Project Site Plant List

Plant Species Observed at the Old Durham Wood Project Site, February-May 2019				
Scientific Name[1]	**Common Name**	**Family**	**Nativity**	**Wetland Indicator Status (Arid West Region)[2]**
Achyrachaena mollis	Blow-wives	Asteraceae	Native	FAC
Alopecurus saccatus	Pacific meadow-foxtail	Poaceae	Native	OBL
Amsinckia intermedia	Common fiddleneck	Boraginaceae	Native	
Anagallis arvensis	Scarlet pimpernel	Myrsinaceae	Naturalized	
Avena barbata	Slender wild oat	Poaceae	Naturalized	
Avena fatua	Wild oat	Poaceae	Naturalized	
Barbarea orthoceras	American yellow-rocket	Brassicaceae	Native	FACW
Blennosperma nanum	Common stickyseed	Asteraceae	Native	FACW
Brodiaea californica	California brodiaea	Themidaceae	Native	
Brodiaea elegans subsp. *elegans*	Elegant cluster-lily, harvest brodiaea	Themidaceae	Native	FACU
Brodiaea minor	Small brodiaea	Themidaceae	Native	
Bromus diandrus	Ripgut grass	Poaceae	Naturalized	
Bromus hordeaceus	Soft brome, soft chess	Poaceae	Naturalized	FACU
Callitriche heterophylla	Greater water-starwort	Plantaginaceae	Native	OBL
Calochortus luteus		Liliaceae	Native	
Centaurea solstitialis	Yellow star-thistle	Asteraceae	Naturalized	
Centromadia fitchii	Fitch's false tarplant	Asteraceae	Native	FACU
Cerastium glomeratum	Sticky mouse-ear chickweed	Caryophllyaceae	Naturalized	UPL
Cicendia quadrangularis	Oregon timwort	Gentianaceae	Native	FAC
Cotula coronopifolia	Common brassbuttons	Asteraceae	Naturalized	OBL
Crassula saginoides [Crassula aquatica]	Water pygmyweed	Crassulaceae	Native	OBL
Crassula tillaea	Moss pygmyweed	Crassulaceae	Naturalized	FACU
Cuscuta howelliana	Boggs Lake dodder	Convolvulaceae	Native	
Deschampsia danthonioides	Annual hair grass	Poaceae	Native	FACW
Downingia bicornuta var. *bicornuta*	Double-horn calico-flower	Campanulaceae	Native	OBL
Downingia cuspidata	Toothed calico-flower	Campanulaceae	Native	OBL
Draba verna		Brassicaceae	Naturalized	
Eleocharis acicularis	Needle spike-rush	Cyperaceae	Native	OBL
Eleocharis macrostachya		Cyperaceae	Native	
Elymus caput-medusae	Medusa-head grass	Poaceae	Naturalized	
Epilobium densiflorum	Dense-flower willowherb	Onagraceae	Native	FACW
Erodium botrys	Long-beak stork's-bill	Geraniaceae	Naturalized	FACU
Erodium brachycarpum		Geraniaceae	Naturalized	
Eryngium castrense	Great Valley eryngo, Great Valley coyote-thistle	Apiaceae	Native	OBL
Festuca myuros	Rat-tail six-weeks grass	Poaceae	Naturalized	FACU
Festuca perennis	Perennial rye grass, Italian ryegrass	Poaceae	Naturalized	FAC
Geranium dissectum		Geraniaceae	Naturalized	
Glyceria declinata	Waxy manna grass, low manna grass	Poaceae	Naturalized	FACW

Plant Species Observed at the Old Durham Wood Project Site, February-May 2019				
Scientific Name[1]	**Common Name**	**Family**	**Nativity**	**Wetland Indicator Status (Arid West Region)[2]**
Hesperevax caulescens	Dwarf pygmy-cudweed, hogwallow starfish	Asteraceae	Native	OBL
Hordeum marinum subsp. *gussoneanum*	Seaside barley, Mediterranean barley	Poaceae	Naturalized	FAC
Hordeum murinum subsp. *leporinum*	Wall barley, hare barley	Poaceae	Naturalized	FACU
Juncus bufonius var. *bufonius*	Toad rush	Juncaceae	Native	FACW
Lasthenia californica	California goldfields	Asteraceae	Native	FACU
Layia fremontii		Asteraceae	Native	
Lepidium nitidum	Shining pepperwort	Brassicaceae	Native	FAC
Limnanthes douglasii subsp. *rosea*	Douglas' meadowfoam	Limnanthaceae	Native	OBL
Limosella acaulis	Owyhee mudwort	Scrophulariaceae	Native	OBL
Limosella aquatica	Awl-leaf mudwort	Scrophulariaceae	Native	OBL
Lupinus bicolor	Miniature lupine	Fabaceae	Native	
Lythrum hyssopifolia	Hyssop Loosestrife	Lythraceae	Naturalized	OBL
Marsilea vestita subsp. *vestita*	Hairy water-clover	Marsileaceae	Native	OBL
Medicago praecox		Fabaceae	Naturalized	
Mimulus douglasii	Brownies	Phrymaceae	Native	FACW
Mimulus glabratus [Mimulus guttatus]	Seep monkey-flower	Phrymaceae	Native	OBL
Montia fontana	Fountain candy-flower, water chickweed, blinks	Montiaceae	Native	OBL
Myosurus minimus	Tiny mousetail	Ranunculaceae	Native	OBL
Navarretia intertexta	Needle-leaf pincushion-plant	Polemoniaceae	Native	FACW
Navarretia leucocephala subsp. *leucocephala*	White-flower pincushion-plant	Polemoniaceae	Native	OBL
Navarretia pubescens		Polemoniaceae	Native	
Phleum pratense	Common timothy, cultivated timothy	Poaceae	Naturalized	FACU
Pilularia americana	American pillwort	Marsileaceae	Native	OBL
Plagiobothrys canescens		Boraginaceae	Native	
Plagiobothrys greenei	Greene's popcorn-flower, Greene's spiny-nut popcornflower	Boraginaceae	Native	FACW
Plagiobothrys nothofulvus	Rusty popcorn-flower, foothill snowdrops	Boraginaceae	Native	FAC
Plagiobothrys stipitatus var. *stipitatus*	Stalked popcorn-flower, showy Great Valley popcornflower	Boraginaceae	Native	FACW
*Plantago elongata**	Prairie plantain	Plantaginaceae	Native	FACW
Plantago erecta		Plantaginaceae	Native	
Plectritis ciliosa	Long-spur seablush	Valerianaceae	Native	FACU
Poa annua	Annual blue grass	Poaceae	Naturalized	FACU
Pogogyne zizyphoroides	Sacramento mesa-mint, Sacramento beardstyle	Lamiaceae	Native	OBL
Polygonum aviculare	Yard knotweed, knotgrass	Polygonaceae	Naturalized	FACW
Psilocarphus brevissimus var. *brevissimus*	Dwarf woollyheads	Asteraceae	Native	FACW
Rumex crispus	Curly dock	Polygonaceae	Naturalized	FAC

Plant Species Observed at the Old Durham Wood Project Site, February-May 2019				
Scientific Name[1]	**Common Name**	**Family**	**Nativity**	**Wetland Indicator Status (Arid West Region)[2]**
Rumex pulcher	Fiddle dock	Polygonaceae	Naturalized	FAC
*Sedella pumila**	Sierran mock stonecrop	Crassulaceae	Native	FAC
Senecio vulgaris	Old-man-in-the-spring, common groundsel	Asteraceae	Naturalized	FACU
Sherardia arvensis	Field madder	Rubiaceae	Naturalized	
Silybum marianum		Asteraceae	Naturalized	
Trifolium angustifolium	Narrow-leaved clover	Fabaceae	Naturalized	
Trifolium campestre	Hop clover	Fabaceae	Naturalized	
Trifolium depauperatum	Balloon sack clover	Fabaceae	Native	FAC
Trifolium dubium	Suckling clover, little hop clover	Fabaceae	Naturalized	UPL
Trifolium hirtum	Rose clover	Fabaceae	Naturalized	
Trifolium repens	White clover	Fabaceae	Naturalized	FACU
Trifolium subterraneum	Subterranean clover	Fabaceae	Naturalized	
Trifolium variegatum	White-tip clover	Fabaceae	Native	FAC
Triglochin scilloides	Flowering-quillwort	Juncaginaceae	Native	OBL
Triphysaria eriantha	Butter-and-eggs, johnny-tuck	Orobanchaceae	Native	
Triteleia hyacinthina	Fool's-onion, white brodiaea	Themidaceae	Native	FAC
Veronica peregrina subsp. *xalapensis*	Neckweed, purslane speedwell	Plantaginaceae	Native	OBL
Vicia sativa	Garden vetch	Fabaceae	Naturalized	FACU
Vicia villosa subsp. *varia*		Fabaceae	Naturalized	
Zeltnera venusta	California centaury, charming centaury	Gentianaceae	Native	

[1]Scientific nomenclature follows Baldwin, B., G., Douglas H. G., David J. K., Robert P., Thomas J. R., and Dieter H. W. 2012. The Jepson Manual: Vascular Plants of California. Second edition, revised and expanded. Berkeley, CA: University of California Press.

[2]Wetland indicator status definitions are provided below (Lichvar 2012).

Indicator Category	**Wetland Occurrence**
OBL (Obligate Wetland Plants)	Almost always occur in wetlands.
FACW (Facultative Wetland Plants)	Usually occur in wetlands, but may occur in non-wetlands.
FAC (Facultative Wetland Plants)	Occur in wetlands and non-wetlands.
FACU (Facultative Upland Plants)	Usually occur in non-wetlands, but may occur in wetlands.
UPL (Obligate Upland Plants)	Almost never occur in wetlands.

The wetland indicator status definitions were obtained from: Lichvar, R., N. Melvin, M. Butterwick, and W. Kirchner. 2012. National Wetland Plant List Indicator Rating Definitions. ERDC/CRREL TN-12-1

Plant wetland indicator statuses were obtained from: U.S. Army Corps of Engineers. 2016. NWPL Version 3.1. http://rsgisias.crrel.usace.army.mil/NWPL/

Appendix B

U.S. Fish & Wildlife Service iPAC Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: October 13, 2020
Consultation Code: 08ESMF00-2021-SLI-0110
Event Code: 08ESMF00-2021-E-00267
Project Name: Old Durham Wood South

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2021-SLI-0110

Event Code: 08ESMF00-2021-E-00267

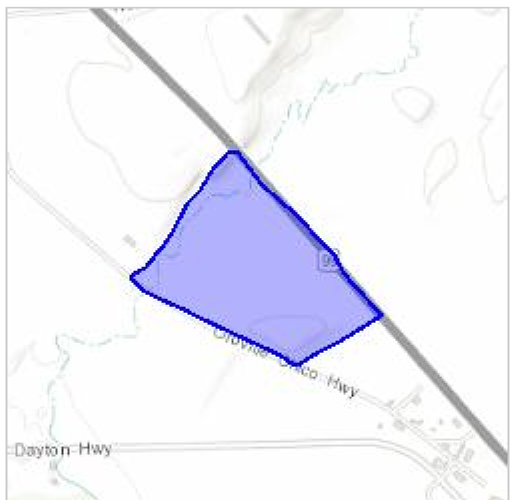
Project Name: Old Durham Wood South

Project Type: ** OTHER **

Project Description: expansion

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/39.65486996136998N121.73544184722797W



Counties: Butte, CA

Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Reptiles

NAME	STATUS
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/205/office/11420.pdf	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850 Habitat assessment guidelines: https://ecos.fws.gov/ipac/guideline/assessment/population/436/office/11420.pdf	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Greene's Tuctoria *Tuctoria greenei* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1573	Endangered
Hairy Orcutt Grass *Orcuttia pilosa* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2262	Endangered
Hoover's Spurge *Chamaesyce hooveri* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3019	Threatened

Critical habitats

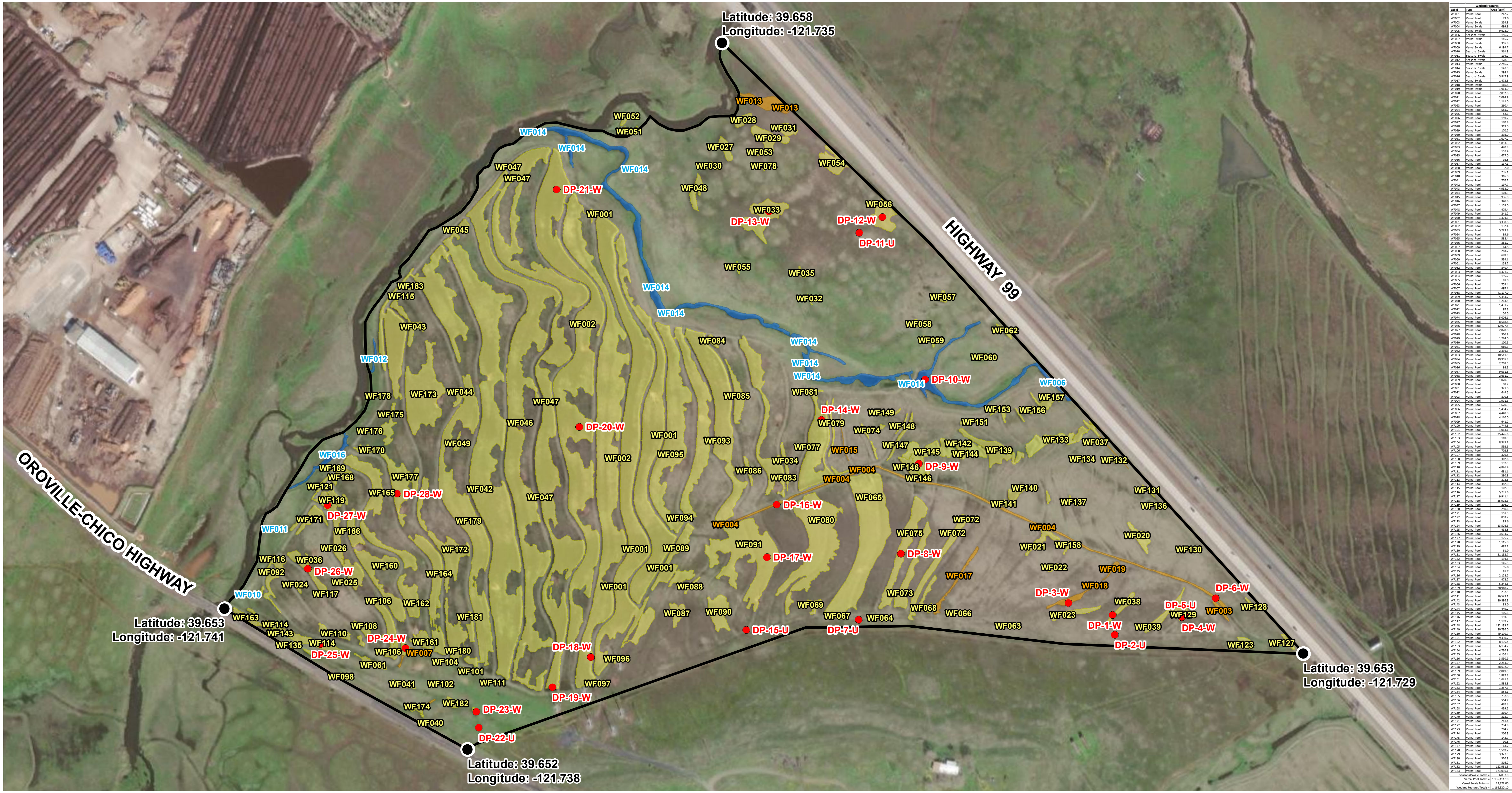
There are 4 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Greene's Tuctoria *Tuctoria greenei* https://ecos.fws.gov/ecp/species/1573#crithab	Final

NAME	STATUS
Hairy Orcutt Grass *Orcuttia pilosa* https://ecos.fws.gov/ecp/species/2262#crithab	Final
Hoover's Spurge *Chamaesyce hooveri* https://ecos.fws.gov/ecp/species/3019#crithab	Final
Vernal Pool Tadpole Shrimp *Lepidurus packardi* https://ecos.fws.gov/ecp/species/2246#crithab	Final

Appendix C

Draft Wetlands Delineation Map



- Control Point
- Data Point
- Survey Area Boundary (87.6 acres)

Wetland Features - WF# - 26.744 acres

- Seasonal Swale (0.912 acres)
- Vernal Pool (25.356 acres)
- Vernal Swale (0.476 acres)

Feet
0 150 300 600
1 inch = 300 feet

Date Prepared: September 29, 2020
Prepared by: J. Williams, VESTRA Resources, Inc.

EXHIBIT A
DRAFT MAP OF THE
WATERS OF THE U.S.
OLD DURHAM WOOD
BUTE COUNTY, CALIFORNIA

VESTRA

SOURCE: MAXAR FEBRUARY 11, 2019 AERIAL PHOTOGRAPH

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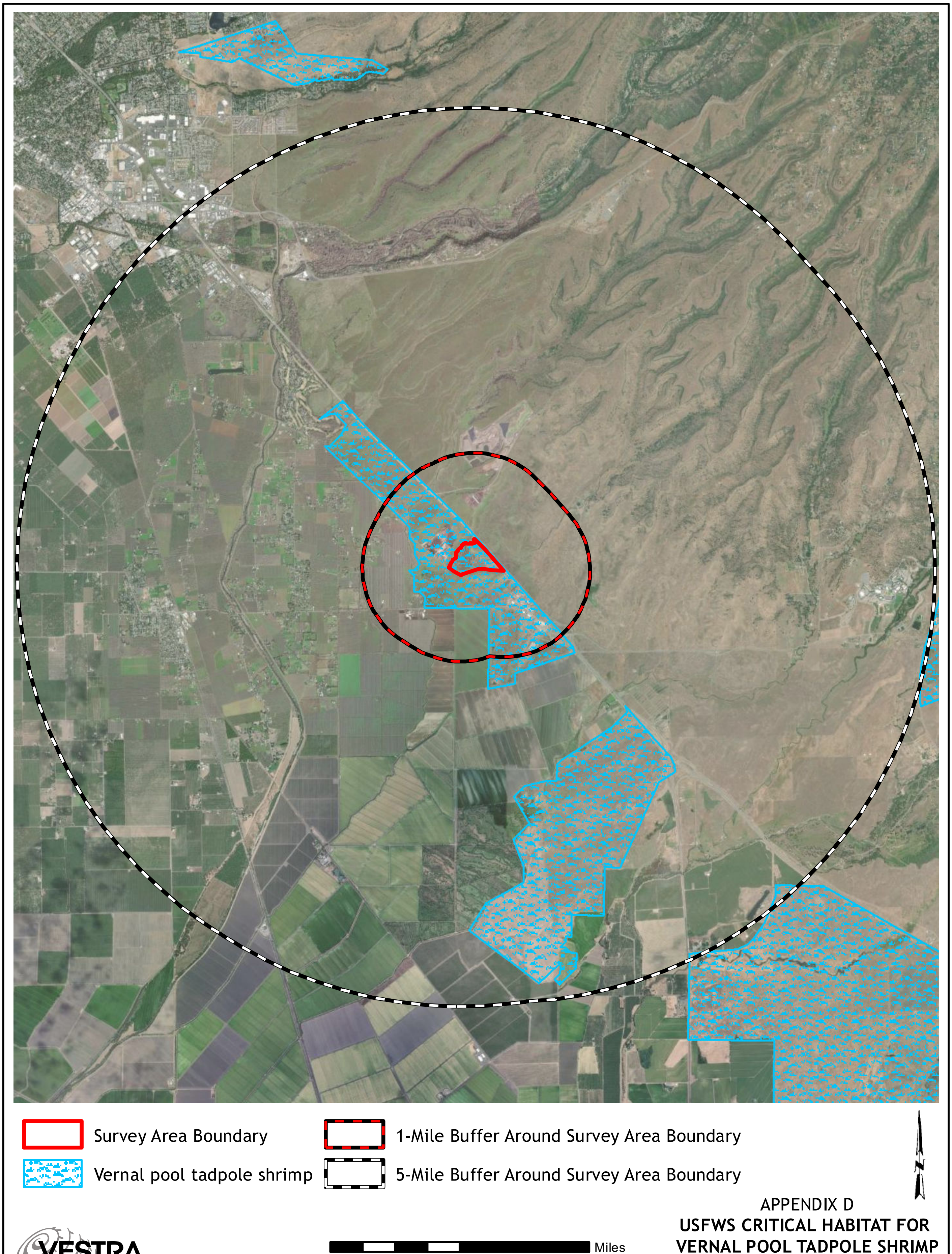
Appendix D

USFWS Critical Habitat for Vernal Pool Tadpole Shrimp



APPENDIX D
USFWS CRITICAL HABITAT FOR VERNAL POOL TADPOLE SHRIMP
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

SOURCE: USFWS 2020

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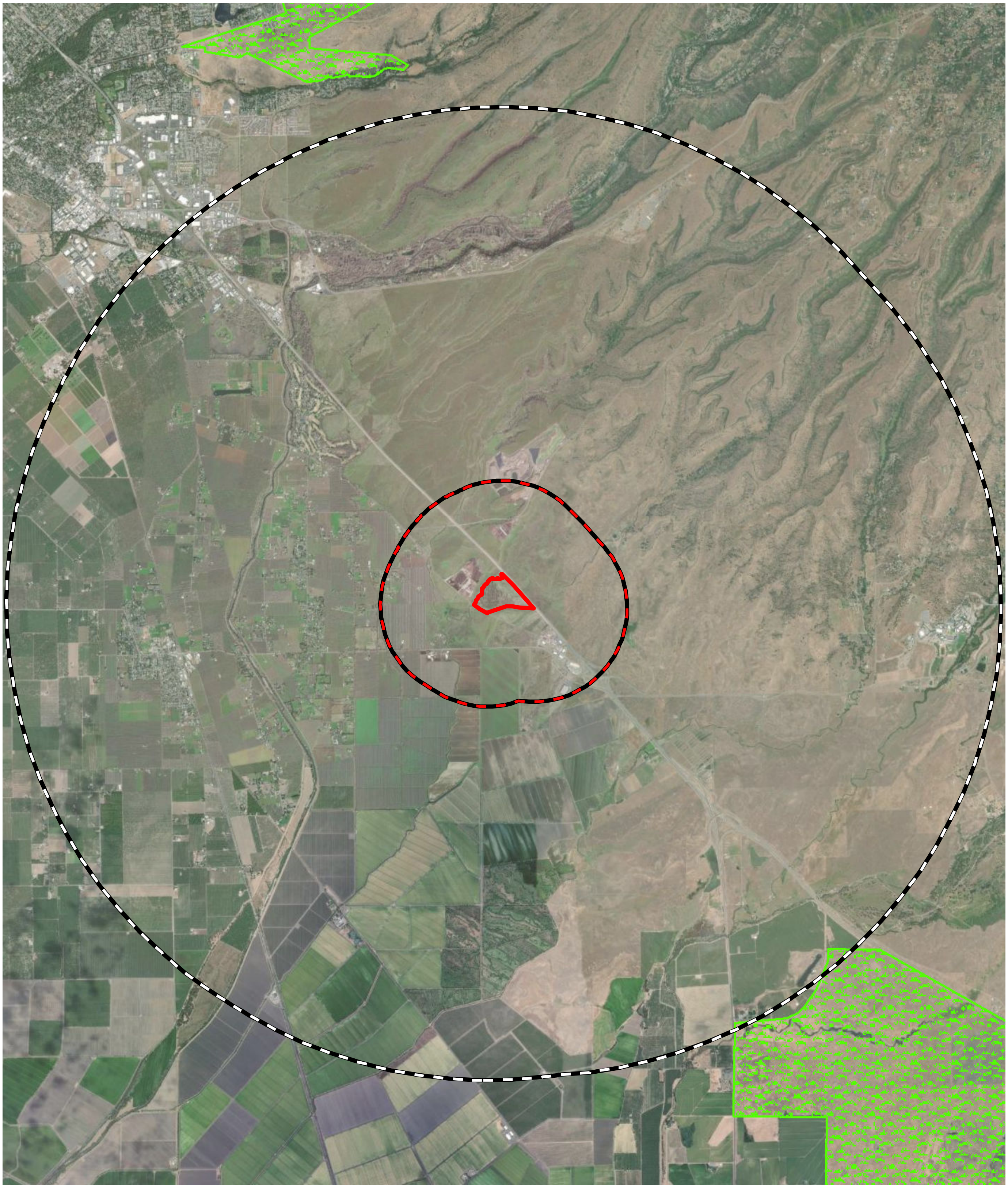
Appendix E

USFWS Critical Habitat for Butte County Meadowfoam



Survey Area Boundary

Butte County meadowfoam

1-Mile Buffer Around Survey Area Boundary

5-Mile Buffer Around Survey Area Boundary

0 0.75 1.5 3 Miles

VESTRA

SOURCE: USFWS 2020

APPENDIX E

USFWS CRITICAL HABITAT FOR BUTTE COUNTY MEADOWFOAM

OLD DURHAM WOOD, INC.

DURHAM, CALIFORNIA

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ATTACHMENT C

ARCHAEOLOGICAL SURVEY REPORT

OLD DURHAM WOOD COMPANY PROJECT
1156 ORO-CHICO HIGHWAY
BUTTE COUNTY, CALIFORNIA

Prepared for:

Vestra Resources, Inc.
5300 Aviation Drive
Redding, CA 96002

Prepared by:

Alex DeGeorgey, M.A., RPA
15 Third Street
Santa Rosa, CA 95401

ALTA 2020-48

Key Words: USGS 7.5' Hamilton Canyon Quad; 25 acre Project Area; T21N, R02East, Unsectioned portion of the Esquen Land Grant; Negative Survey; No Adverse Effects

26 August 2020

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I. SUMMARY OF FINDINGS

The following Archaeological Survey Report (ASR) documents the adequacy of identification efforts and presents the results of investigations within the limits of the proposed project and surrounding lands (Project Area). The study was designed to identify any archaeological, historical, or cultural resources located within the Project Area. Fieldwork was conducted on August 7, 2020 by Alex DeGeorgey, Sierra DeGeorgey, and Risa DeGeorgey. The survey employed an intensive examination of the ground surface. A total of about 42 acres of land were surveyed. No cultural resources were identified within the project area as a result of records search or archaeological field survey. The project, as presently designed, is not anticipated to have an adverse effect on significant cultural resources and should be allowed to proceed.

II. INTRODUCTION

Alta Archaeological Consulting (ALTA) was retained to conduct a cultural resources inventory as part of the Old Durham Wood Company Project (Project). An archaeological field survey was completed by ALTA on August 7, 2020 for the purpose of identifying cultural resources within the Project Area. For the purposes of this investigation, the most sensitive portions of Project Area were surveyed, totaling approximately 42 acres. No cultural resources were identified within the Project Area. The following cultural resources survey report documents the adequacy of identification efforts, presents the results of investigations within the Project Area boundaries. This cultural resources evaluation report addresses the responsibilities of the California Environmental Quality Act (CEQA), as codified in Public Resources Code sections 5097, and it's implementing guidelines 21082 and 21083.2.

Qualifications of Preparer

Mr. DeGeorgey holds a Masters of Arts degree in Anthropology from the California State University, Chico. He has 25 years professional archaeological experience working for both the public sector and private agencies engaged in the management of cultural resources in Northern California. Mr. DeGeorgey meets the Secretary of the Interior's standard for cultural resource specialists involved in preservation activities at all levels of government involving historic-era and prehistoric-era archaeological resources. He also plays an active role in the Society for California Archaeology, Society for American Archaeology, the Register of Professional Archaeologists, and local historical organizations.

III. PROJECT LOCATION AND DESCRIPTION

The project setting is an undeveloped vacant lot adjacent the northwest side of the existing Old Durmham Wood Company. The Project is situated on APN 040-120-036. The physical address of the property is 1566 Oro-Chico Highway, Durham, California. The approximately 25-acre project location is approximately 6 miles southeast of the City of Chico in Butte County, California. State Route 99 is situated about 400 feet east (Figure 1). The project is situated in Township 21, North, Range 02 East, in and unsectioned portions of Esquen Land Grant of the Mount Diablo Base and Meridian (Figure 2).

The Old Durham Wood Company intends to expand operations to include approximately 25 acres of land located on the northwest side of the existing facility. Improvements would include a proposed yard office measuring 20'-x-20', truck scale, two warehouse buildings each measuring 200'-x-200', a fire system pipeline with six fire hydrants, as well as other improvements.

IV. REGULATORY CONTEXT

This section briefly discusses the nature and extent of State regulations that apply to the Project. As part of the compliance process the Project must comply with CEQA as amended; and it's implementing regulations and guidelines, codified in Title 14 of the California Code of Regulations (CCR), which provide agencies guidance for compliance with environmental regulations.

California Environmental Quality Act

The CEQA applies to certain projects requiring approval by State and/or local agencies. Property owners, planners, developers, as well as State and local agencies, are responsible for complying with CEQA's requirements regarding the identification and treatment of historical resources. Applicable California regulations are found in California PRC Sections 5020 through 5029.5 and Section 21177, and in CEQA (CCR Sections 15000 through 15387). CEQA equates a substantial adverse change in the significance of a historical resource with a significant effect on the environment (PRC Section 21084.1). A substantial adverse change includes demolition, destruction, relocation, or alteration that would impair the historical significance of a resource (PRC Section 5020.1). PRC Section 21084.1 stipulates that any resource listed in, or eligible for listing in, the California Register of Historical Resource (CRHR) is presumed to be historically or culturally significant. Under CEQA, cultural resources that will be affected by an undertaking must be evaluated to determine their eligibility for listing in the CRHR (PRC Section 5024.1(c)).

For a cultural resource to be deemed eligible for listing, it must meet at least one of the following criteria:

1. is associated with events that have made a significant contribution to the broad patterns of California History and cultural heritage; or
2. is associated with the lives of persons important to our past; or
3. embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possess high artistic value; or
4. has yielded or is likely to yield, information important to prehistory or history.

The eligibility of archaeological sites is usually evaluated under Criterion 4 –its potential to yield information important to prehistory or history. Whether or not a site is considered important is determined by the capacity of the site to address pertinent local and regional research themes. The process for considering cultural resources on CEQA projects is essentially linear, although in practice it may overlap or be compressed. Evaluating prehistoric properties involves four basic tasks: (1) development of an archaeological research design (2) field excavations, (3) laboratory analysis, and (4) report preparation and eligibility determination.

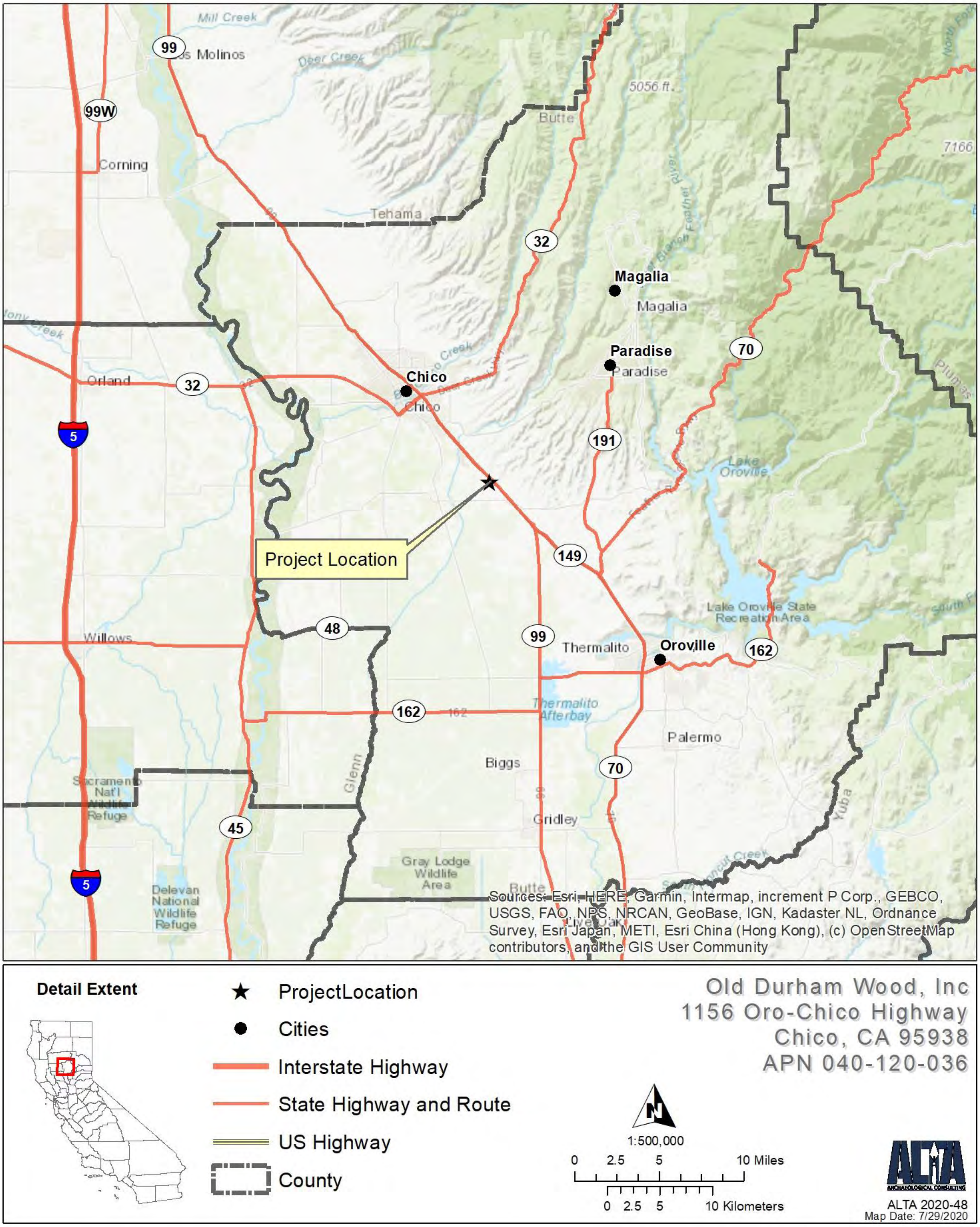

Figure 1. Project Vicinity

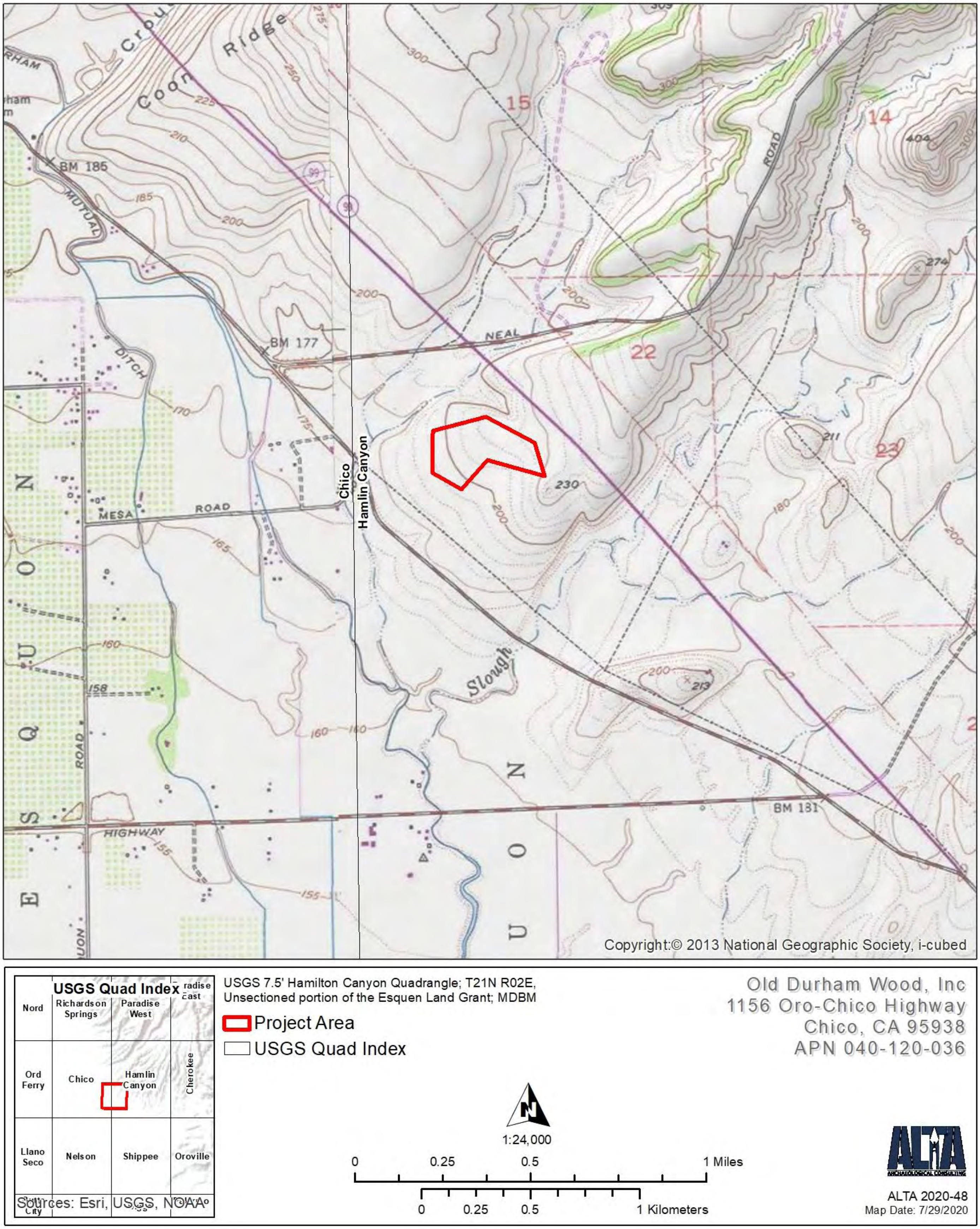

Figure 2. Project Location

V. BACKGROUND

As the significance of cultural resources is best assessed with regard to environmental and cultural contexts, descriptions of the natural and cultural setting of the project region are presented below.

Environment

The Project Area is situated in the foothill area of the Big Chico Creek watershed, a 45 mile long stream that originates on Colby Mountain and terminates at its confluence with the Sacramento River. Elevations within the Project Area range from about 190 to 220 feet above mean sea level. This area is situated near the interface of the Sierra Nevada Range and the Cascade Range.

The local geology is composed of three main formations: the Tuscan Formation; Lovejoy Basalt; and the Chico Formation. The Chico Formation is the oldest, dating to approximately 75 million years ago and comprised is sedimentary rock, mostly of sandstone, that contains numerous marine fossils.

The local vegetation community represents a desert grasslands. Perennial grasses, Purple Needle grass (*Stipa pulchra)* was particularly important, occur in varying proportions. Most growth occurred in the late spring after winter rains and the onset of warmer and sunnier days. Interspersed among the bunchgrasses were a rich array of annual and perennial grasses and forbs, the latter creating extraordinary flowering displays during certain years. Some extensive mass flowerings of the California poppy (*Eschscholtzia californica*), lupines (*Lupinus spp.),* and Purple Owl Clover (*Orthocarpus purpurascens*) still occasionally occur in several foothill areas (Schoenherr 1992).

Prehistory

Over half a century of archaeological investigations in the Southern Cascade and Sierra Nevada has revealed a record of hunter-gatherer occupation spanning over 10,000 years (Baumhoff 1957, Elsasser 1960, 1978, Elston 1971, 1982, 1986, Elston et al. 1977, 1994, 1995, Heizer and Elsasser 1953, Moratto 1984, Kowta 1988, Prichard et al. 1966, Ritter 1968, 1970, Olsen and Riddell 1963). The cultural chronology of the project area is best described as part of the overall cultural chronology for the Southern Cascade Range (Baumhoff 1957 and Kowta 1988). The earliest documented evidence of occupation in the region began about 11,000 to 8,000 years BP, referred to as the Western Pluvial Lakes Tradition (Kowta 1988). Archaeological sites dating to this time period tend to be situated along the margins of large pluvial lakes, indicate non-intensive or temporary occupation suggesting a nomadic settlement system with an emphasis on hunting of large terrestrial mammals and waterfowl. A diagnostic artifact of this time is the “crescent stone” that is associated with lacustrine adaptation and exploitation, possibly water fowling (Kowta 1988).

During the mid-Holocene, between 8,000 to 5,000 years BP, the climate shifted to warmer conditions giving way to a new adaptation known as the Great Basin Archaic Tradition, a lifeway that lasted well over 3,000 years. This period is characterized by a focus on seed processing (milling slabs and handstone) and big game hunting (atlatl), mostly at high elevation (Kowta 1988). Diagnostic artifact types of this period include Northern Side-Notched and Pinto projectile points, which have been documented at Bucks Lake (Kowta 1988).

Beginning about 4,950 to 3,950 years BP, populations increased dramatically as suggested by the frequency of sites in conifer and oak woodland zones. This time period is known locally as the Martis Tradition, a wide-spread adaptation present along the western Sierra and Southern Cascade Range (Elston 1971,1979; Elston et al. 1977; Riddell and Pritchard 1971; Johnson 1980). A characteristic feature of this tradition is the prevalence of stone tools from locally available tool stone, primarily basalt (Kowta 1988). Projectile points (contracting stem and corner notch) are found in high ratios to milling slabs and handstone, suggesting an emphasis on hunting.

The cultural chronology of Butte County was originally defined in the 1960s as a result of large scale archaeological investigations associated with the construction of Lake Oroville (Olsen and Riddell 1963). Subsequently, refined by other archaeologists (Prichard et al. 1966; Ritter 1968, 1970, and others) the cultural sequence of Butte County currently includes five time periods: the Mesilla, Bidwell, Sweetwater, Oroville and Historic periods (Table 1).

Table 1. Cultural Sequences for Butte County (Olsen and Riddell 1963; Ritter 1970)

Phase	Indicators	(Years BP)
Historic	Reservations, revitalization movements	170 – present (post A.D. 1830)
Oroville	Mortar and pestles, shell ornamentation, late projectile points, silicate toolstone, acorns, and high incidences of fixed settlements.	500 – 170 (A.D. 1500 – 1830)
Sweetwater	Mortars and pestles, smaller projectile points, shift from basalt to chert and obsidian toolstone, reliance on acorns, decreasing mobility.	1200 – 500
Bidwell	Millingstones, handstones, emphasis on basalt, steatite artifacts, variety of projectile points, grooved net weights, and decreasing mobility.	2000 – 1200
Mesilla	Millingstones, leaf-shaped, stemmed or side-notched, emphasis on basalt, polished bone tools, *Haliotis* ornaments, *Olivella* M-series beads, charmstones, flexed burials, high levels of mobility.	3000 – 2000

Ethnography

The Maidu and Konkow inhabited this region of the northern Sacramento Valley and Sierra Nevada foothills prior to Euro-American intrusion (Riddell 1978:370-386). They are represented locally by the Mechoopda Band of Konkow Indians (Dixon 1905). The following ethnographic summary is not intended as a thorough description of Maidu culture but instead is meant to provide a background to the present cultural resource investigation with specific references to the project area. Primary sources of ethnographic information include Dixon (1905), Powers (1877), Kroeber (1925). In this section, the past tense is sometimes used when referring to native peoples because this is a historical study. This convention is not intended to suggest that Maidu people only existed in the past. To the contrary, many Maiduian groups have strong cultural and social identities today.

The Maidu were never a single consolidated tribe, but instead were represented by numerous politically independent bands and tribelets. Each tribelet consisted of one or more villages and a number of camps with the tribelet's territory. The central village was usually the most populous and the residence of the community leader who served as the primary advisor and spokesman (Kroeber 1925:397). Individual villages were autonomous and self-sufficient, not politically bound under any strict control of the community leader. The Konkow, like neighboring groups, followed a yearly gathering cycle traveling seasonally from winter villages on the river into the Sierra foothills to hunt and gather. Konkow primarily subsisted on freshwater fish, acorns and terrestrial game (Riddell

1978:370-386). Any member of a community could procure food from the territory fishing, hunting and gathering areas were held in common. Within the common lands certain families could claim fishing holes as their own and permission was required for other tribal members to use these areas (Dixon 1905:224-227).

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Perhaps the first contact between the Mechoopda and Europeans occurred in 1811, when Padre Abella explored the San Joaquin and Sacramento Valleys. In 1832-3, John Work traveled through the northern Sacramento Valley as part of a fur trapping expedition for the Hudson Bay Company (Riddell 1978). Members of his party had malaria resulting in a pandemic that had a catastrophic effect on native peoples. The mass insurgence of Euroamericans during the Gold Rush in 1848-9 led to additional waves of disease spread, violence, and environmental destruction. In 1851, the Mechoopda convinced their territory and were force to move on reservations. In 1992, the Mechoopda achieved Federal recognition by the United States government codifying their status as a native sovereign nation.

Local History

Chico was founded by General John Bidewll in 1843. The following year, William Dickey was granted the Rancho Arroyo Chico by Mexican Governor Manuel Micheltorena, which were subsequently purchased by Bidwell in 1849 and 1851. The city of Chico was founded in 1860 by Bidwell who surveyed and established the street grid.

The Gold Rush (1848-9) brought a wave of immigrants to California. Locally, Big and Little Butte Creeks were among of the richest gold mining localities in the county. The area of Big Chico Creek, having a fundamentally different geology, was spared the effects of these mining efforts. The opening of the Humboldt Road in 1864 made available vast tracts of previously inaccessible timberlands. Shipping logs with horse drawn wagons along the Humboldt Wagon Road was inefficient and a timber companies sought a better system to transport lumber to sawmills in Chico.

The Butte Flume and Lumber Company constructed the Big Chico Creek Flume between 1872 and 1874. The 38-mile long flume ran through Big Chico Creek canyon and was used to transport rough-cut lumber from sawmills in the mountains to the community of Chico. An engineering marvel of the time, the flume was constructed in a V-shape, four to five feet wide at the top with an average drop of 27 feet per mile. The flume flowed continually and a series of flume tenders stations (cabins) were set up at intervals along the route to support the operation. A telegraph line was put along the flume to connect to communicate between mills and flume tenders stations. The Butte Flume and Lumber Company owned and operated the flume for four years (1872-1876). Ownership transferred to the Sierra Flume and Lumber Company (1976-178), and the Sierra Lumber Company (1878-1907). The flume ceased operations when the Diamond Match Company took over ownership in 1907 (Dennison and Nopel 1998:50-55, Hutchinson 1974:12-21).

The Durham Ranch began with Samuel Neal and David Dutton, the original owns of the Rancho Esquon. Robert W. Durham came to California in 1852 and became associated with Sam Neal, helping him with his accounts and managing his huge grant. When Sam Neal died, he left his 240 acre farm to Durham plus “all the land I own on the north side of Butte Creek…” The land became a ranch when Robert W. Durham’s nephew, William Wellington Durham, inherited his uncle’s land and purchased even more land on which to raise horses and cattle. In 1874, William married Minnie Van Ness and in 1878, a son Robert, was born to them. William represented Butte County in the legislature in 1879-80. The Durham Milling Company was organized in 1895, with W. W. Durham as president. The first mill was a one-stone bur steam mill which was later destroyed by fire. A new mill was built in 1900 with a steam roller process. Around this same time, O. C. Pratt was planting the first almond trees in Durham, Butte County became one of the leading almond-producing counties in the state. E. A. Epperson and Durham were responsible for the full-scale commercial growing of almonds in 1895. When Minnie died, William married a school teacher Caroline Roesch. In 1906, William's son, Robert married Edna Reynolds and had three children—William W., Robert W. Jr., and Elizabeth Ruth. The marriage was an unhappy one due to Roberts's unpredictable fits of temper and irresponsibility toward his family and home. Robert finally left the ranch, his wife, and children and went to live alone in a solitary cabin. Because he had neglected his bills, the Durham home was forfeited and the land sold by the bank. In 1941, Robert died of cerebral hemorrhage. (Durham Ranch Records, 1848-1916. California State University, Chico).

VI. SOURCES CONSULTED

Records Search

On July 3, 2020, Casey Hegel, Research Assistant with the Northeast Information Center (NEIC), conducted a records search (File Number D20-70) of the California Historical Resources Information System. The NEIC, an affiliate of the State of California Office of Historic Preservation is the official state repository of archaeological and historical records and reports for an 11-county area that includes Butte County. The records search included a review of all study reports on file within the Project Area and all resources within a 1-mile radius. Sources consulted include archaeological site and survey base maps, survey reports, site records, and historic General Land Office (GLO) maps.

Included in the review were:

- *California Inventory of Historical Resources* (California Department of Parks and Recreation 1976)
- *California Historical Landmarks* for Butte County (CA-OHP 1990)
- *California Points of Historical Interest* (CA-OHP 1992)
- *Historic Properties Directory* (CA-OHP April 2012), including the National Register of Historic Places, California Historical Landmarks, and California Points of Historical Interest

Review of archaeological site and survey maps revealed that no previous cultural resource studies have been performed within the Project area. No cultural resources are documented within the 1-mile search radius. Attachment A provides the records search results.

Historic Map Review

Review of historic maps of the area was completed to better understand the timing of development within the project area and recognize historic features. The following historic maps were reviewed as part of this investigation.

General Land Office (GLO)

1873 Plat Map for T23N R02E. March 20, 1873.

McGrann, James (Butte County Surveyor)
1877 *Official Map of the County of Butte, California.*

United States Geological Survey (USGS)
1891 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.
1893 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.
1895 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.
1953 Paradise Topographic Quadrangle Map, 1:62,500 scale.
1958 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.

No historic-era resources are depicted within the project area on any of the above listed map references.

Ethnographic Literature Review

Available ethnographic literature was reviewed to identify cultural resources in the project vicinity. The following sources were consulted.

Dixon, Roland B.
1905 The Northern Maidu. *Bulletin of the American Museum of Natural History* 17(3):119-346.

Kroeber, Alfred L.
1925 Handbook of the Indians of California. *Bureau of American Ethnology* Bulletin 78. Washington D.C.

Powers, Stephen
1877 Tribes of California. *Contributions to North American Ethnology* 3. U.S. Geographical

Riddell, F.A.
1978 Maidu and Konkow. In *Handbook of North American Indians: California* 8:370-386. Smithsonian, Washington.

The Konkow had four villages on the east side of the upper part of Big Chico Creek canyon (Riddell 1978:371). These include the named ethnographic villages of *Yauko*, O'dawi, *Otaki*, and *Tsulumsemi* (Dixon 1905, Kroeber 1925, Powers 1877). No ethnographic resources are documented wuithin 2 miles of the project area.

Native American Consultation

On July 29, 2020, archaeologist Alex DeGeorgey contacted the Native American Heritage Commission (NAHC) to request a review of the Sacred Lands file for information on Native American cultural resources in the study area and to request a list of Native American contacts in this area. To date, no response has been received from the NAHC regarding this project. Attachment B provides copies of the Native American correspondences.

VII. FIELD METHODS

ALTA archaeologists Alex DeGeorgey, Sierra DeGeorgey, and Risa DeGeorgey conducted a field survey of the Project Area on March 30 through August 7, 2020. Project maps and aerial imagery were loaded into Avenza software and carried by field crews to correctly identify survey polygons within the Project Area. Ground surface visibility varied considerably but was generally good, 20-40%, throughout the survey area.

A total of 42 acres of land were surveyed that included the entire project area and surroundings (Figure 3). Intensive coverage with transect spacing no greater than 20 meter intervals was completed. Digital photos were taken of the Project Area and surroundings (Attachment C).

VIII. STUDY FINDINGS AND MANAGEMENT RECOMMENDATIONS

Study Findings

As previously discussed in section IV, this cultural resources inventory was conducted to address the responsibilities of CEQA, as codified in Public Resource Code sections 5097, and its implementing guidelines 21082 and 21083.2 and Section 106 of the NHPA (36 CFR 800.5(a)(1)).

The records search and archaeological field survey did not identify any cultural resource within the project area.

Management Recommendations

We make the following recommendations to ensure that cultural resources are not adversely affected by the proposed project. The project as presently designed is not expected to have an adverse effect on cultural resources. The project should be allowed to proceed given the following recommendations.

Unanticipated Discovery of Cultural Resources

If previously unidentified cultural resources are encountered during project implementation, avoid altering the materials and their stratigraphic context. A qualified professional archaeologist should be contacted to evaluate the situation. Project personnel should not collect cultural resources. Prehistoric resources include, but are not limited to, chert or obsidian flakes, projectile points, mortars, pestles, and dark friable soil containing shell and bone dietary debris, heat-affected rock, or human burials. Historic resources include stone or abode foundations or walls; structures and remains with square nails; and refuse deposits or bottle dumps, often located in old wells or privies.

Encountering Native American Remains

Although unlikely, if human remains are encountered, all work must stop in the immediate vicinity of the discovered remains and the County Coroner and a qualified archaeologist must be notified immediately so that an evaluation can be performed. If the remains are deemed to be Native American and prehistoric, the Native American Heritage Commission must be contacted by the Coroner so that a “Most Likely Descendant” can be designated and further recommendations regarding treatment of the remains is provided.

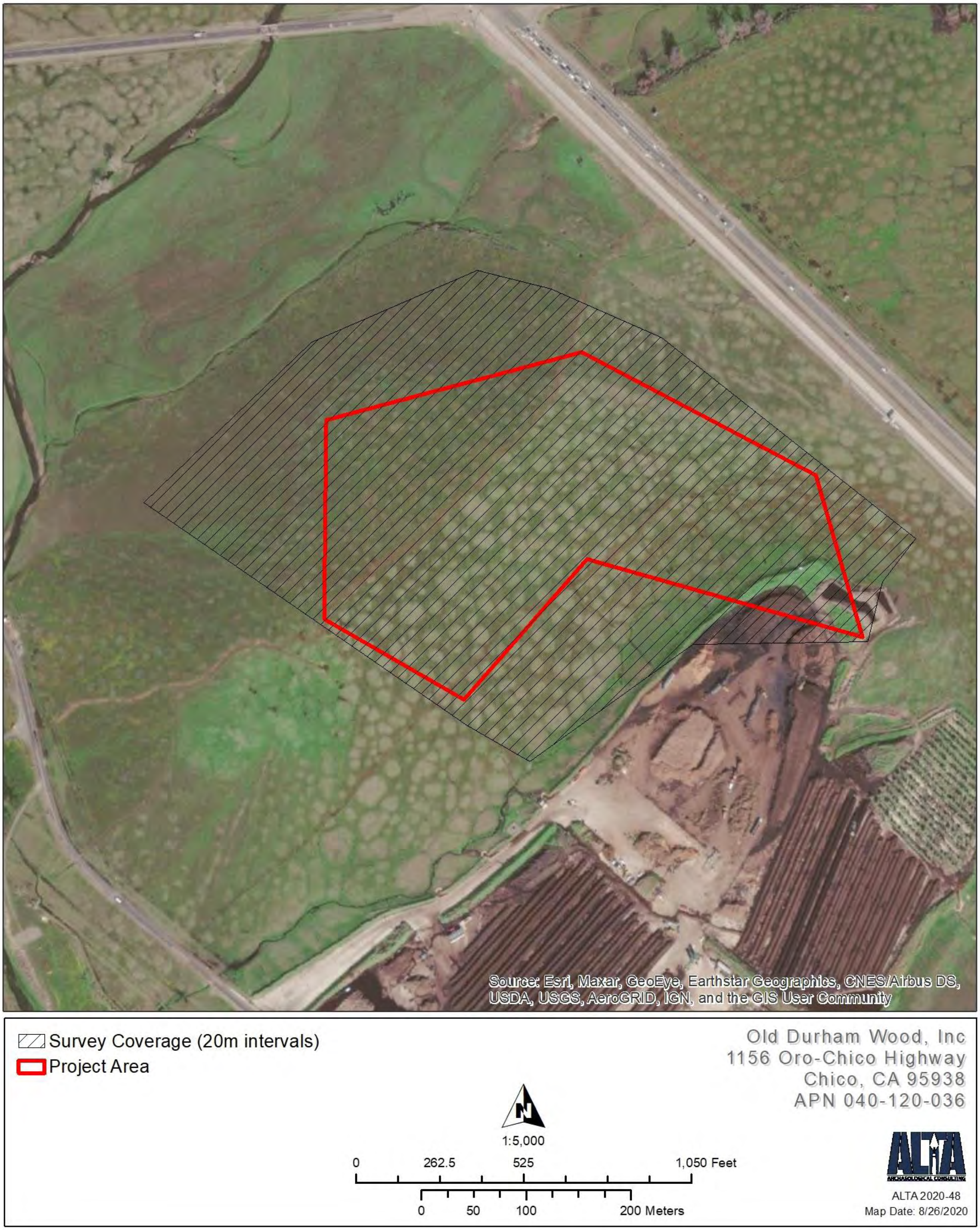

Figure 3. Survey Coverage

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1891 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.
1893 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.
1895 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.
1953 Paradise Topographic Quadrangle Map, 1:62,500 scale.
1958 Chico Topographic Quadrangle Map, 1:250,000 scale. Reston, VA.
1978 Cohasset Topographic Map, 1:24,000 scale.

Attachment A – Records Search Results

OLD DURHAM WOOD COMPANY PROJECT
1156 ORO-CHICO HIGHWAY
BUTTE COUNTY, CALIFORNIA

Confidential Information

This report contains confidential information. The distribution of material contained in this report is restricted to a need to know basis. To deter vandalism, artifact hunting, and other activities that can damage cultural resources, the location of cultural resources should be kept confidential. The provision protecting the confidentially of archaeological resources is in California Government Code 6245 and 6245.10, and the National Historic Preservation Act of 1996, Section 304.

Northeast Center of the
California Historical Resources
Information System

BUTTE
GLENN
LASSEN
MODOC
PLUMAS
SHASTA

SIERRA
SISKIYOU
SUTTER
TEHAMA
TRINITY

123 West 6th Street, Suite 100
Chico CA 95928
Phone (530) 898-6256
neinfocntr@csuchico.edu

RECEIVED
JUL 13 2020
BY: W

July 3, 2020

Ms. Wendy Johnston
VESTRA Resources, Inc.
5300 Aviation Drive
Redding, California 96002

I.C. File # D20-70
Non-Confidential
Records Search

RE: 71730/ APN 040-120-036
T21N R2E unsectioned MDBM
USGS Hamlin Canyon 7.5'
287.34 acres (Butte County)

Dear Ms. Johnston,

In response to your request, a records search for the project cited above was conducted by examining the official maps and records for archaeological sites and surveys in Butte County.

RESULTS:

Prehistoric Resources: According to our records, no sites of this type have been recorded within the project area or 1-mile project vicinity. There is an unrecorded prehistoric resource within a mile of the project area, which consisted of shell fragments, teeth, and beads. The project is located in a region utilized by Konkow Maidu population. Unrecorded prehistoric cultural resources may be located within the project area.

Historic Resources: According to our records, no sites of this type have been recorded within the project area or 1-mile project vicinity. Unrecorded historic cultural resources may be located in the project area.

The USGS Hamlin Canyon (1951) 7.5' quad map indicates that the project area is southwest of Hamlin Canyon. The project area is located east of the town of Durham. The USGS Oroville (1944) 15' quad map shows that the project area is located northwest of the town of Oroville.

Within the project area is Hamlin Slough and Oroville-Chico Highway. Located in the general project vicinity are Neal Road, Mesa Road, Highway 99, and ditches.
The 1867 General Land Office (GLO) plat map indicates that the project area falls within the Esquon Rancho, which was a 22,194-acre Mexican land grant.

Previous Archaeological Investigations: According to our records, the project area has not been previously surveyed for cultural resources.

Literature Search: The official records and maps for archaeological sites and surveys in Butte County were reviewed. Also reviewed: **National Register of Historic Places - Listed properties and Determined Eligible Properties** (2012); **California Inventory of Historic Resources** (1976); **Gold Districts of California – Bulletin 193** (2012); **Built Environment Resource Directory** (2019); **Handbook of North American Indians, Vol. 8, California** (1978); and **A Collection of Places in Butte County, California : a geographical and historical dictionary of gold camps, towns, railroad stations, schools, post offices, rivers, streams, gulches, bars, and other place designations** (1977).

RECOMMENDATIONS:

Based upon the above information and the local topography, and regional history, the project is located in an area considered to be sensitive for prehistoric, protohistoric, and historic cultural resources. Konkow Maidu populations used the local region for seasonal and permanent settlement, as well as for the gathering of roots and seeds, fishing, and hunting seasonal waterfowl and game. Historically, the region was utilized for farming and cattle ranching, and transportation operations.

Therefore, because the project area has not been previously surveyed, we recommend that a professional archaeologist be contacted to conduct a cultural resources survey of the entire project area. The project archaeologist will be able to offer recommendations for the preservation of or mitigation of effects on any cultural resources encountered as a result of field survey. A list of qualified consultants is available online at www.chrisinfo.org.

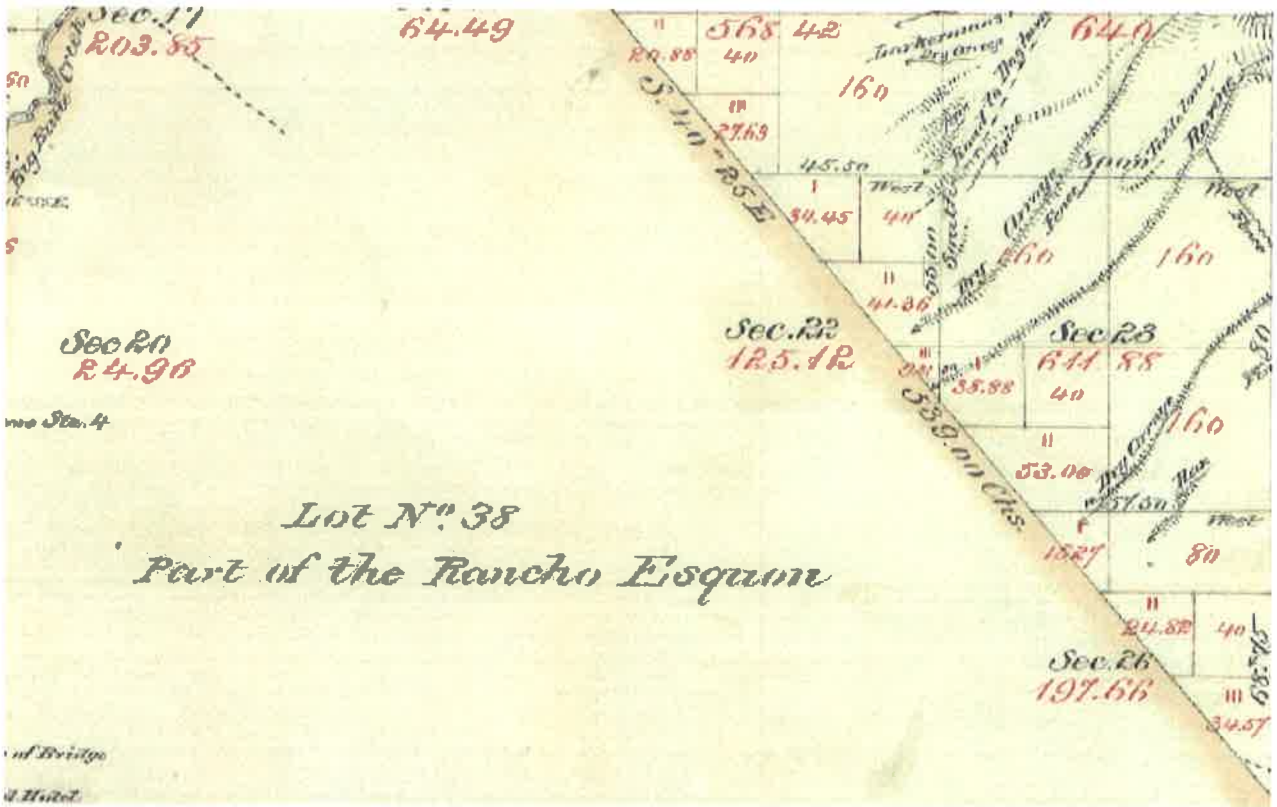
The project archaeologist should also contact the appropriate local Native American representatives for information regarding traditional cultural properties that may be located within project boundaries for which we have no records. The Native American Heritage Commission should be contacted at (916) 373-3710 for information regarding Native American representatives in the vicinity of the project.

During any phase of parcel development, if any potential prehistoric, protohistoric, and/or historic cultural resources are encountered, all work should cease in the area of the find pending an examination of the site and materials by the project archaeologist. This request to cease work in the area of a potential cultural resource find is intended for accidental discoveries made during construction activities, and is not intended as a substitute for the recommended cultural resources survey.

The fee for this records search is $150.00 (1 hour of Information Center time @ $150.00 per hour). An invoice will follow from Chico State Enterprises for billing purposes. Thank you for your concern in preserving Butte County's and California's cultural heritage, and please feel free to contact us if you have any questions or need any further information or assistance.

Sincerely,

Casey Hegel
Research Assistant



Sec.17
203.85
64.49
568.42
640
Sec 20
24.96
Sec.22
125.12
Sec 23
611.88
Lot No. 38
Part of the Rancho Esquon
Sec.26
197.66
539.00 Chs.

Attachment B – Native American Communication

OLD DURHAM WOOD COMPANY PROJECT
1156 ORO-CHICO HIGHWAY
BUTTE COUNTY, CALIFORNIA

Confidential Information

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Local Government Tribal Consultation List Request

NATIVE AMERICAN HERITAGE COMMISSION

915 Capital Mall, RM 364
Sacramento, CA 95814
(916) 373-3710
(916) 373-5471 – Fax
nahc@nahc.ca.gov

Date: 07-29-2020

<u>Type of List Requested</u>

■ **CEQA Tribal Consultation List (AB 52)** – ***Per Public Resource Code §21080.3, subs. (b), (d), (e) and 21080.3.2***

☐ **General Plan (SB 18)** – ***Per Government Code §65352.3.***

Local Action Type:

__General Plan	__General Plan Element	__General Plan Amendment
__Specific Plan	__Specific Plan Amendment	__Pre-planning Outreach

<u>Required Information</u>

Project Title: Old Durham Wood, Inc. (ALTA20-48)
Local Government/Lead Agency: Butte County Planning Division
Contact Person:
Street Address: 7 County Center Dr.
City: Oroville Zip: 95965
Phone: (530) 552-3700 Fax:
Email:

Specific Area Subject to Proposed Action

County: Butte **City/Community:** Chico

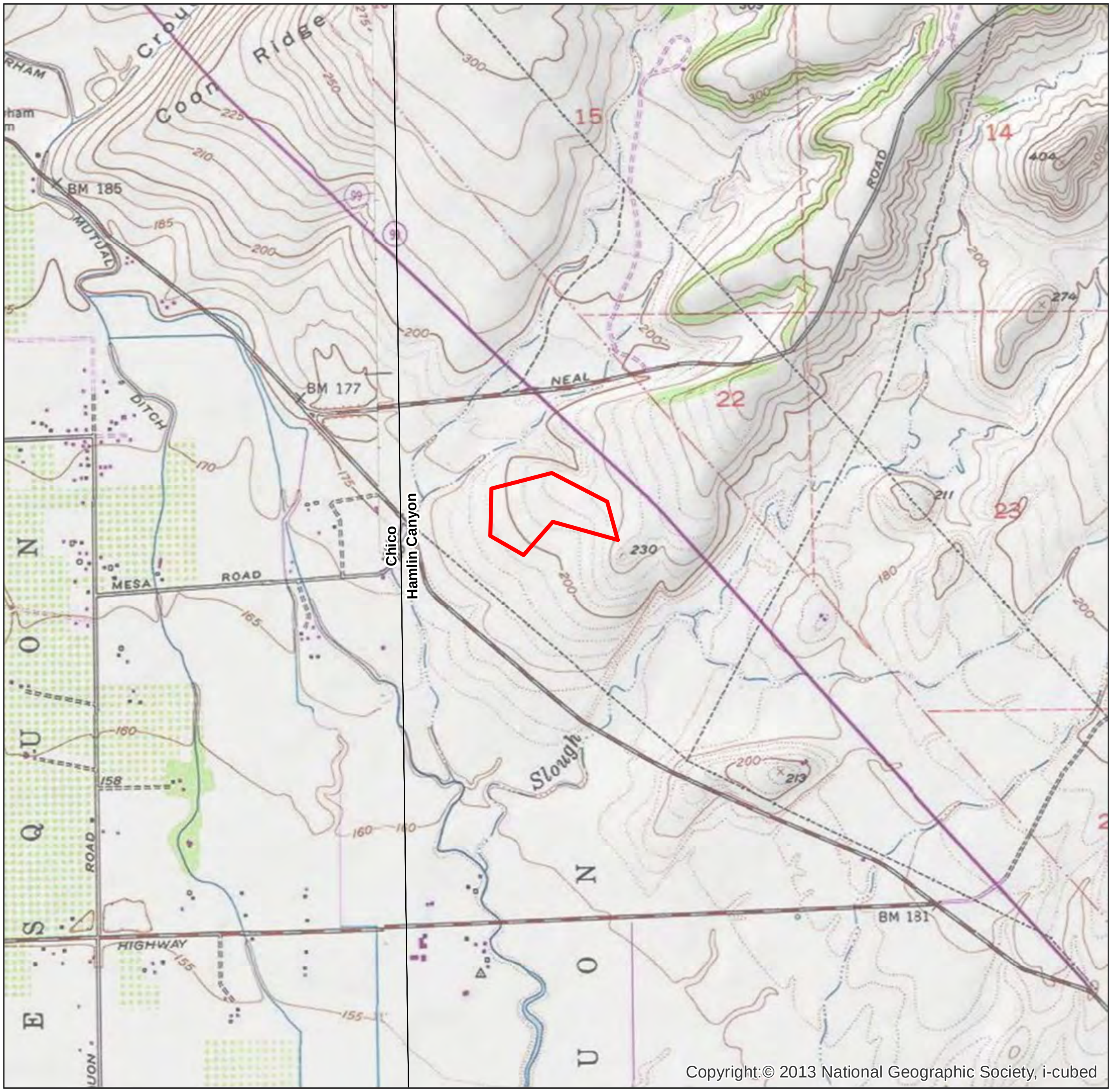
Project Description: The project includes installation of fire hydrants, pipelines, a road, and two buildings. The project is located at 1156 Oro-Chico Highway within an unincorporated area south of the City of Chico.

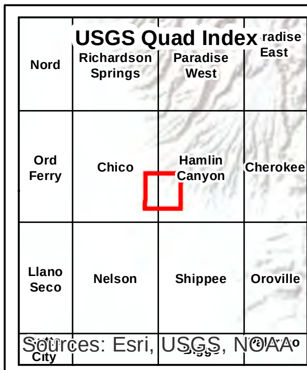
Additional Request

■ ***Sacred Lands File Search – Required Information***

USGS 7.5' Quadrangle(s): Hamilton Canyon

Legal Description: Township 02N, Range 02E, Unsectioned portion Esquon land grant (map attached) .





USGS 7.5' Hamilton Canyon Quadrangle; T21N R02E, Unsectioned portion of the Esquen Land Grant; MDBM

Project Area

USGS Quad Index

Old Durham Wood, Inc
1156 Oro-Chico Highway
Chico, CA 95938
APN 040-120-036

1:24,000

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

ALTA 2020-48
Map Date: 7/29/2020

Attachment C – Photo Sheet

OLD DURHAM WOOD COMPANY PROJECT
1156 ORO-CHICO HIGHWAY
BUTTE COUNTY, CALIFORNIA

IMG_2624, Overview of project area, view east, 08/07/2020

IMG_2626, Overview of southeastern project area, view south, 08/07/2020.

ATTACHMENT D

Agricultural Maintenance Plan

Old Durham Wood

(Name)

NOXIOUS WEED and AGRICULTURAL PEST MAINTENANCE/MANAGEMENT PLAN

1156 & 974 Oroville-Chico Highway
Durham, California
(Address)

General Information and Data Page

Authorized representative: Tim Merrill
Title: Operations Manager
APN: 040-120-036

I am submitting an agricultural weed maintenance plan. I understand that this plan is conditional and pursuant to the Agricultural Element, County General Plan, and will require approval by the Agricultural Commissioner's Office. I agree to adhere to the following conditions and maintain the required documents. I understand that this plan may require changes in the future to address unforeseen pest control circumstances.

Check list of documents:

- [X] An Agricultural Maintenance Plan, signed by the authorized representative.
- [X] A map of the site identifying the crop and pesticide application areas.
- [ ] Pesticides permit and current use reports:
  OP ID/RMP Number: Will be obtained if needed
- [ ] Any other pertinent agricultural permits or certification.
  (Organic, CPC, Nursery, Weed Free Certification): N/A
- [ ] Registration with the Butte-Yuba-Sutter Watershed Coalition if required.
  N/A
- [ ] Agricultural Burn Permit (if agricultural burning is to take place) from the Air Quality Management District: N/A

Responsible Pest Control Business or pest control employee:
Tim Merrill, Operations Manager
Phone numbers: 530-570-0207

Signature: ____________________ **Date:** 10-6-20

General Conditions for Certification:

- A detailed map of the project area is required.
- A designated individual or Pest Control Business (or both) must be assigned as responsible for the required weed control activities:
- The applicant must promptly and aggressively pursue noxious weed control in the project area, including access roads, and meet all conditions to prevent the transport of noxious weeds, from or to public or private lands on transport vehicles.
- Noxious weed control must be continual and ongoing until control is gained, to the satisfaction of the Agricultural Commissioner's Office.
- The weed management plan will be updated in consultation with a County Weed Biologist as necessary to prevent infestation and spread from weed infested areas.
- Vehicles or machinery will not park in or unnecessarily drive through weed infested areas.
- Erosion control products (hay or straw) or groundcover or any other imported natural material used must be noxious weed free from a **certified** source.
- Promptly take action to remove identified noxious weeds.
- Identified noxious weeds must not be allowed to reach the flowering or seed dispersal stage.
- Prevent small noxious weed patch reproduction (vegetative spread and seed dispersal) while steadily replacing removed weeds with desired plants (naturally or through re-vegetation)
- Prevent weed invasion, establishment, and growth in "protected" areas (high quality areas with highly desirable plant cover, relatively weed-free)
- Prevent or greatly reduce weed seed production and dispersal along roadways and waterways, and from crossing onto neighboring property.

Specific Conditions for Certification:

Access roads: Access roads will be maintained free of weeds using herbicides

Composting stockpiles, green waste, and storage areas: Composting stockpiles and compost storage areas do not generate weeds. Due to maximum temperature required, composting kills weed seeds.

Treatment of contaminated stock: Nursery stock is not received at the facility

Equipment and vehicle parking and storage areas: These areas are paved and will not be sources of weed seed.

Timing of chemical sprays and control activities: Control activities will be conducted as needed should a noxious or invasive plant pest be noted. Generally, these activities will be physical removal; however, sprays may be used if needed. Generally, chemical control is applied for broadleaf plants in the early spring and for grasses as soon as identifiable in spring and early summer.

Disposition of slash or cutting debris containing noxious weed seeds: Disposal of slash or other material containing weed seeds is not anticipated to occur.

Priority weed and pest species list: See attached.

Review:
Agricultural Department Representative: ___________________________Date:__________

Site Summary

The total acreage under the control of Old Durham Wood is 287. Of this, approximately 80 acres are currently used for site operations. Expansion into the 35 acres to the north of the current facility is planned. The remaining acres are used as rangeland. Rangeland to be managed, parcel boundaries, and developed areas are shown on Figure 1.

The parcel has been used for winter cattle grazing since approximately 1974. Number of head grazed varies with forage quality and quantity, which is dependent on seasonal variability but are generally from 20 to 30 head. The past year the number increased to 50 head.

Stormwater from the site, which contains organic matter and limited nutrients, is discharged into the rice checks on the southern portion of the site as a filtration system. The stormwater hydrates these soils and extends the growing season as well as provides some nutrients. The resultant forage is significantly better with higher yield.

Old Durham Wood intends to improve the forage quality in the filter area to 1) provide additional filtration and 2) allow a higher carrying capacity. These improvements include application and incorporation of compost and seeding with dryland forage mix.

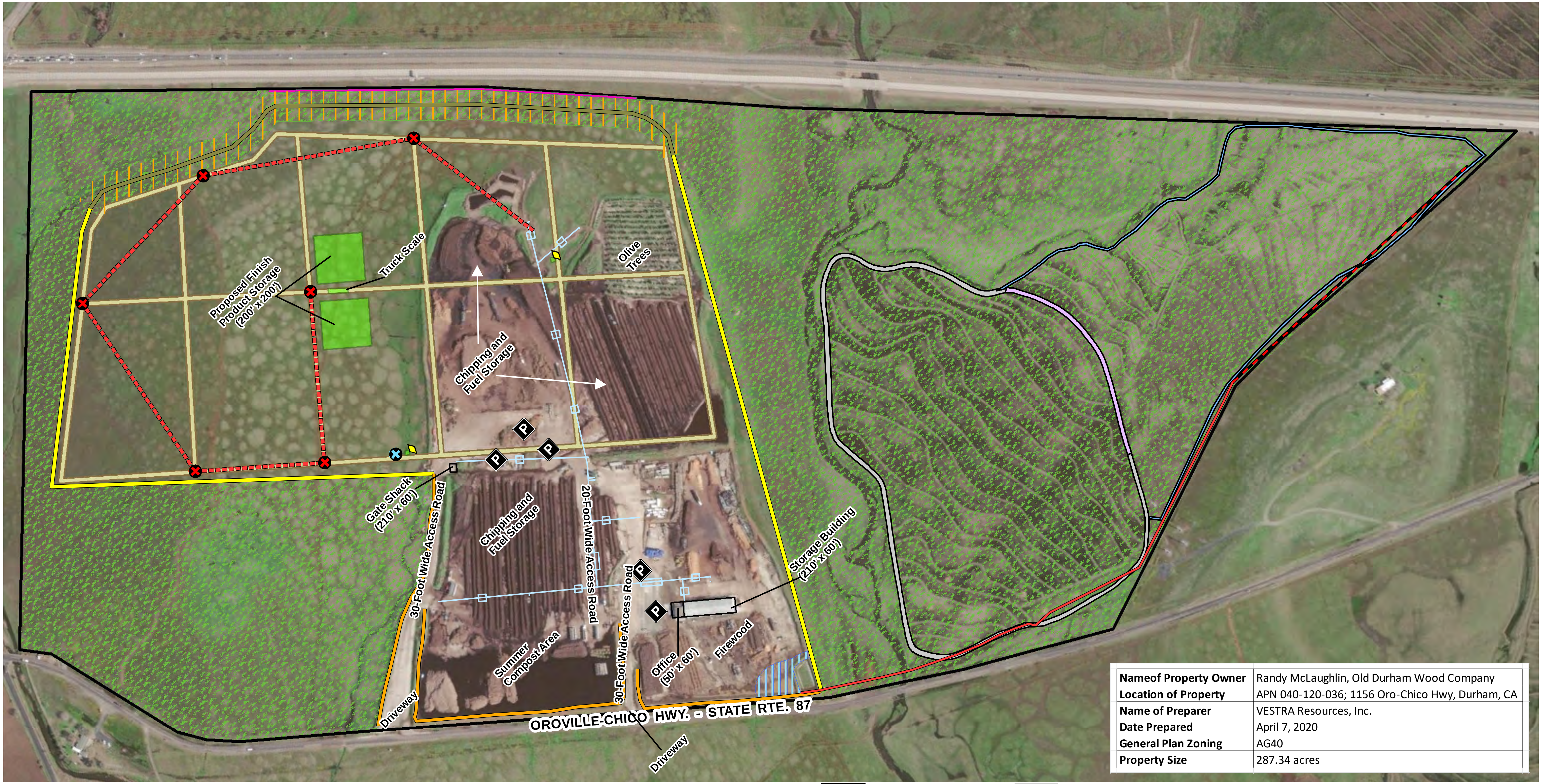
Old Durham Wood has planned the use of a grazing berm to the east to reduce land loss for grazing.

The parcel has been heavily disturbed in the past. The land was developed for rice cultivation during the 1960s and 1970s. This agricultural pursuit continued into the 1980s when it was abandoned. The land has been used for cattle grazing since that time. Rice field berms are still present and mostly intact, with breaks in these berms for draining fields into Hamlin Slough prior to harvest still evident. The rice fields act as detention ponds for precipitation. The fields were observed during the months of February and March to determine when water levels would recede enough to allow fieldwork. The checks have drained through rice check box depressions into Hamlin Slough. Old Durham uses the historical rice fields as a biofilter for stormwater from the site prior to discharge to Hamlin Slough.

The habitat present within the parcel is one of Annual Grassland with naturalized upland plant species dominating. Within the rice checks, this habitat is dominated by hydrophytic vascular plant species.

Climatically, the project is located in a Mediterranean climate with hot dry summers and cool wet winters. The average annual precipitation is 25.69 inches and the average annual temperature is 60.8 Fahrenheit (NRCS 2018). The winter of 2018-2019 saw higher than normal precipitation, with rainfall from October 2018 to April 2019 reaching 31.50 inches (UCCE: Butte County, Chico-Durham).

Elevations onsite range from 180 feet above mean sea level (amsl) at the southwest corner of the project to 170 feet amsl at the north boundary of the project (Hamlin Slough). There is a very gradual, slight grade of 0 to 2 percent northerly towards Hamlin Slough throughout the project area.



Nameof Property Owner	Randy McLaughlin, Old Durham Wood Company
Location of Property	APN 040-120-036; 1156 Oro-Chico Hwy, Durham, CA
Name of Preparer	VESTRA Resources, Inc.
Date Prepared	April 7, 2020
General Plan Zoning	AG40
Property Size	287.34 acres

Proposed Septic
Proposed Fire Hydrant
Proposed Well
Parking
Stormwater Pipeline
Proposed Expansion of Stormwater Pipeline
Berm
Proposed Outside Border Berm
Proposed Outside Grazing Berm
Proposed Fire Water System Pipes
Fire System Water Pipes
Proposed Road
New Road
Reconstructed Road
Proposed Building
Proposed Access Road
Detention Pond
Rocked Access Corridor
Buildings
Approximate Parcel Boundary
Rangeland

N

0 200 400 800 Feet

1 inch = 400 feet

VESTRA

SOURCE: DIGITALGLOBE 2018 AERIAL PHOTOGRAPH

FIGURE 1
PROPOSED SITE PLAN
OLD DURHAM WOOD, INC.
DURHAM, CALIFORNIA

P:\GIS\71730\Figures\Re-ApplicationPackage\71730_ProposedSitePlan_Rangeland.mxd

The soils onsite are very shallow and not agricultural soils. In many areas of the parcel the lava cap is at the surface with limited vegetative cover. These are the areas of the site planned for the expansion. Soils in areas of the site proposed for expansion are Doemill-Jokerst series soils which are very shallow (<2-10") and with limited water-holding capacity and high runoff. These are not agricultural soils and their ability to support even rangeland value is limited.

Target Species

- Barb goatgrass (*Aegilops triuncialis*)
- Medusahead (*Taeniatherum caput-medusae)*
- Perennial pepperweed (*Brassicaceae Lepidium latifolium*)
- Musk thistle (*Carduus nutans*)
- Purple loosestrife (*Lythrum salicaria*)
- Star-thistle (*Centaurea solstitialis*)

Invasive Species Management Options

Mechanical Treatment
Mechanical removal involves cutting and removal of invasive plants by hand or by machines. Hand crews can use clippers, loppers, weed wrenches, shovels, and chainsaws to pull or remove weeds. Machines such as backhoes, excavators, and brush hogs are desired in large areas with mature plants, especially where hand removal is infeasible.

Chemical Treatment
Chemical treatment focuses on carefully timed applications of specific herbicides to target individual invasive plants. Pest Control Advisor selects appropriate herbicides and a Qualified Pest Applicator applies the herbicides for the target invasive species. Several applications may be necessary to suppress or kill invasive species, often in combination with mechanical treatment to remove biomass. Methods of herbicide application can vary and include basal bark sprays, foliar sprays, and cut and paint applications. Chemical treatment options are shown in Table 1.

Biological Control Treatment
Biological control uses natural enemies to regulate populations of invasive species. Sometimes, the absence of natural enemies may be an important contributing factor to the invasiveness of some plant species. Natural enemies used in classical biological control of weeds include insects and mites, and sometimes nematodes and fungi. It may be a cost-effective approach, but the long-term efficacy of treatment and environmental impacts of releasing an organism to control are not fully understood.

Cultural Control Treatment
Cultural control is the manipulation of the vegetation structure and composition to discourage or limit invasive species. It includes revegetation of native plant species to suppress or prevent the establishment of invasive plants. Other examples of cultural control activities include maintaining a level of canopy closure that impedes shade-intolerant invasive species or developing advanced regeneration that can compete with the invasive plants.

Table 1
SUMMARY OF RECOMMENDED HERBICIDE APPLICATION FOR TARGETED INVASIVE SPECIES

Scientific Name	Common Name	Herbicide	Active Ingredient	Herbicide Rate	Surfactant	Number of Applications Per Year	Application Method
Brassicaceae *Lepidium latifolium*	Perennial pepperweed	Garlon 4/Vastlan	triclopyr	1 qt/acre	Crop oil	2-3	Foliar
Carduus nutans *Centaurea solstitialis*	Musk thistle Star-thistle	Transline	aminopyralid	10 oz/acre		2	Foliar
Lythrum salicaria	Purple loosestrife	Roundup Garlon 4/Vastlan Weedar	glyphosate triclopyr triclopyr 2,4-D amine	1.5 qt/acre 1 pt/acre 1 pt/acre 1 qt/acre	Crop oil	2	Foliar
Taeniatherum caput-medusae *Aegilops triuncialis*	Medusahead Barb goatgrass	Roundup Plateau Milestone	glyphosate imazapic aminopyralid	0.75 pt/acre 4-12 oz/acre 7-14 oz/acre		1 - Fall or early spring	

Plant Identification and Control Sheets

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UC PEER REVIEWED

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Barb Goatgrass

Figure 1. Mature barb goatgrass. *Photo:* J. S. Davy.

JOSH S. DAVY, University of California Livestock and Natural Resources Program Representative, Tehama, Glenn, and Colusa Counties; **JOSEPH M. DITOMASO**, University of California Cooperative Extension Specialist; **EMILIO A. LACA**, Rangeland Ecologist, University of California, Davis

Barb goatgrass (*Aegilops triuncialis* L.; see fig. 1) is a winter annual that is native to Mediterranean Europe and western Asia. Although barb goatgrass was first identified in California in the early 1900s, its rapid spread is relatively recent. Its first introduction into California was associated with the importation of Mexican cattle to El Dorado and Sacramento Counties.

This species is expanding throughout Northern California and the Central and South Coast in areas below 1,100 meters (3,600 feet) in elevation. Barb goatgrass populations quickly create a devastating monoculture (fig. 2) that diminishes species diversity, forage quality and quantity, and wildlife habitat of infested areas. It primarily inhabits dryland fields, roadsides, annual rangelands, and oak woodlands in both disturbed and undisturbed sites. Infestations generally do not occur in irrigated areas. A distinguishing feature of barb goatgrass is its ability to proliferate in varying types of conditions, including serpentine soils where many annual grasses have not prospered.

Barb goatgrass is one of three goatgrass species prevalent in California. The others are jointed goatgrass (*Aegilops cylindrical* Host) and ovate goatgrass (*Aegilops ovata* L.). All three goatgrass species can hybridize with winter wheat (*Triticum aestivum* L.) and are currently B-rated noxious weeds in California by the California Department of Food and Agriculture. A rating of B indicates goatgrass as a species that has a detrimental economic importance, as it is the second-highest of five possible ratings (A, B, C, Q, or D). The rating system is used as a guideline for county agricultural commissioners to establish priority in dealing with pests. Ratings are based on the impact of the pest, the distribution of the pest, and the resulting ability for it to be controlled or eradicated.

Figure 2. Barb goatgrass infestation. *Photo:* J. S. Davy.

Impact of Barb Goatgrass on Rangelands

Barb goatgrass grows in dense stands with a deep and rapidly establishing root system that makes it extremely competitive on annual rangelands. The tillering habit of seedlings (fig. 3) and slowly decomposing thatch creates a mulch that crowds out all other desirable forage and native perennial species and creates monotypic stands that can quickly infest an entire ranch. Barb goatgrass is generally unpalatable to livestock, especially when it matures. Its long awns protrude from the seed head and can cause serious physical injury to grazing animals. Barb goatgrass infestations reduce forage quality and quantity by up to 50 to 75 percent. Because livestock tend to avoid the plant, selective defoliation of more desirable plants promotes the spread of barb goatgrass.

Figure 3. Tillers of barb goatgrass seedling. *Photo:* J. S. Davy.

Identification

Barb goatgrass is generally 20 to 50 centimeters (8-20 in) tall. It is a winter annual that thrives in northern and much of coastal California's mild winter weather. Fine hairs are typically present on the collar, sheath margin, and leaf margin, and sparsely cover the upper and lower leaf. Barb goatgrass ligules are membranous and the auricles are clasping. The young leaves appear rolled when protruding from the sheath of older leaves. The immature stems are solid but become hollow as the plant reaches maturity. Plants in vegetative state can be easily identified by uprooting them and carefully inspecting the base of the plant. Almost all plants are still attached to the spikelet that contained the seed. Once the plant is uprooted, these spikelets are easily identified.

Barb goatgrass frequently grows within medusahead (*Taeniatherum caput-medusae* (L.) Nevski) patches, but it produces a very different seed head that resembles the inflorescence of wheat (fig. 4). It differs from wheat in that the spike is compact and breaks into joints at the nodes of the rachis. The spike typically has four spikelets, or segments, each with one or two florets. The bottom two spikelets usually have two florets, each fertile, while the top two spikelets are generally reduced in fertility and tend to have only one floret each. Although the foliage is generally gray-green throughout the growing season, the spikelets and stem may turn red just prior to maturity. Three long, barbed awns protrude from each glume. These awns have very small barbs and can cause injury to grazing livestock and other wildlife.

Figure 4. Barb goatgrass comparison with other common annual range plants. *Photo:* J. S. Davy.

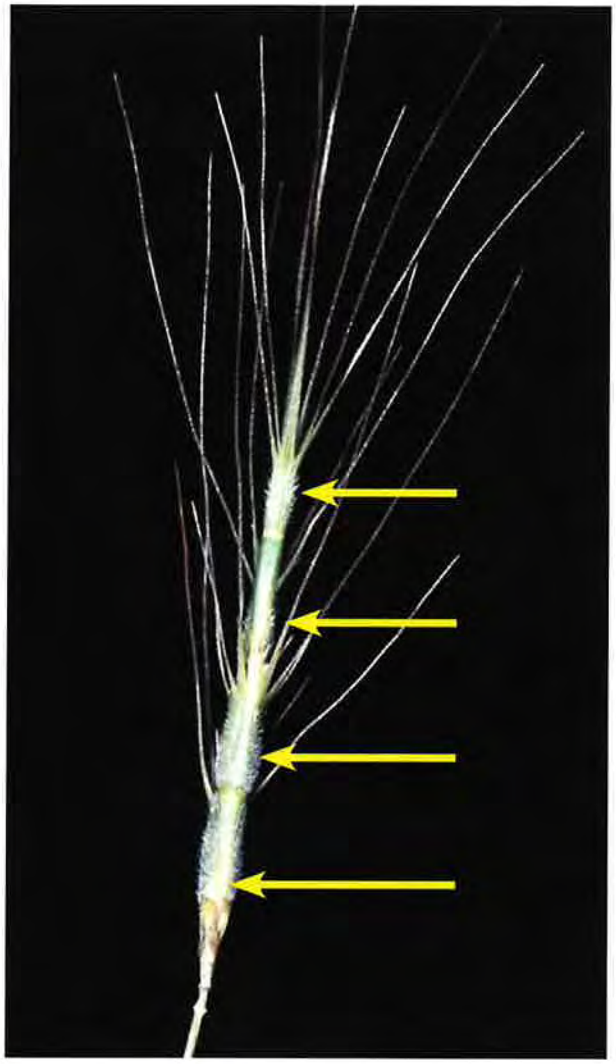

Figure 5. Spikelets of barb goatgrass inflorescence. *Photo:* J. M. DiTomaso.

Figure 6. Individual barb goatgrass spikelet. *Photo:* J. M. DiTomaso.

Life Cycle

Barb goatgrass is a winter annual that germinates with the onset of fall rains and matures between May and August after most common annual grasses, such as soft chess (*Bromus hordeaceus* L.), wild oats (*Avena fatua* L.), annual ryegrass (*Lolium multiflorum* Lam.), ripgut brome (*Bromus diandrus* Roth.), and medusahead (*Taeniatherum caput-medusae* (L.) Nevski). Timing of maturity depends on location, moisture, soil type, and temperature. At maturity, its entire spike drops from the stem and remains intact on the soil surface until it eventually breaks into typically four joints that each contain a spikelet (fig. 5). Even late in the fall it is easy to find entire spikes on the ground in infested areas. In contrast, medusahead seeds drop from the spike individually, leaving a seedless, awned spike in the fall.

Each plant is typically capable of producing four to six seeds. The lower two spikelets are very fertile, while the upper two are less fertile and often sterile. Within each barb goatgrass spikelet (fig. 6), the plant produces two seeds, one larger and another smaller. Researchers (Scott and Dyer 1996) have shown that the large seeds germinate during the first season after seed drop. The large seed, as well as the maternal tissue surrounding the seeds, inhibits the germination of the smaller seed. This can cause the smaller seed to remain dormant for up to 5 years, but more typically 2 years, ensuring the persistence of the infestation even when no new seeds are produced for an entire season. Because of this, effective control strategies require at least 2 years to eliminate most of the smaller dormant seeds in the soil.

Following onset of fall rains, the goatgrass seed germinates inside the spikelet, which remains

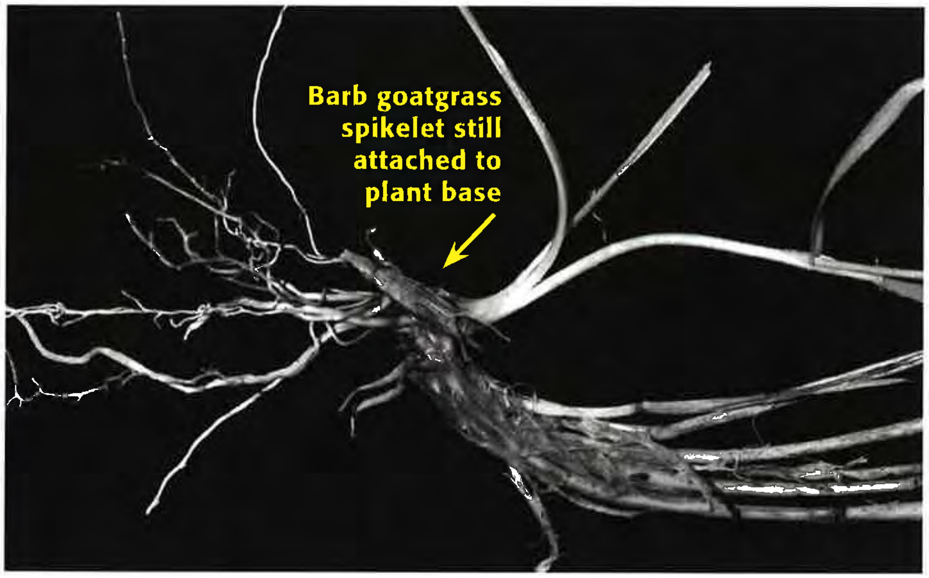

Figure 7. Barb goatgrass seedling with spikelet still attached. *Photo:* E. A. Laca.

attached to the embryonic stalk just below the soil surface (fig. 7). The spikelets of the seed head can be easily viewed when seedling plants are dug up. During the seedling and early vegetative stages, plants grow slightly prostrate and produce numerous tillers, which help to crowd out other annual forages. Barb goatgrass becomes erect during the spring, as maturity nears.

Control

The most important factor in controlling barb goatgrass is early detection. Since seeds do not fall far from the mother plant, early infestations are generally restricted to small areas. However, the barbed awns attach easily to livestock and wildlife, enabling widespread seed distribution through animal movement. In as little as 3 years, an entire pasture or ranch can become infested with barb goatgrass. Seeds of barb goatgrass are also dispersed in hay from dryland pastures, thus spreading to more distant feeding areas and roadsides. Small patches are manageable; however, control of large infestations is extremely difficult. Various control methods have been tested with differing levels of success. In all cases where treatment requires the removal of litter, such as burning, desirable clover or grass species should be reseeded to prevent reinfestation or establishment of another undesirable species.

Burning

Data from research (DiTomaso et al. 2001) at the UC Hopland Research and Extension Center demonstrated that a thorough burn in the late spring when sufficient fire fuel was available, but when seedheads were still attached to the stems, for 2 consecutive years gave excellent control of barb goatgrass infestations. A single burn was not effective, because the dormant seeds remained viable in the seedbank. Multiple burns were also found to increase populations of native species, particularly perennial grasses.

Chemical

Since barb goatgrass populations primarily inhabit rangelands, the options for chemical control are limited. No grass-selective herbicides are registered for rangelands in California for control of barb goatgrass. Chemical control with glyphosate is a practical and effective method if small patches are detected early. Spraying selected patches is very effective in the winter or spring, but it may take 2 years of application to ensure that the seed bank is depleted. When using nonselective herbicides containing glyphosate as a primary ingredient, caution should be taken because they will generally kill all surrounding perennial and annual grasses, forbs, and legumes.

Mowing and Grazing

Early-growing-season mowing alone has shown limited benefit in barb goatgrass control, as low-growing or prostrate plants often escape injury. Heavy grazing during the growing period, followed by rest in late spring, tends to increase the density of barb goatgrass due to the elimination of competing plants and barb goatgrass's strong ability to regrow. Although livestock typically avoid barb goatgrass, intensive grazing or mowing at early stages of seedhead emergence negates the selective feeding behavior of

animals and can be very successful in preventing goatgrass seed formation. Heavy defoliation at and just prior to seed head emergence can be very effective in limiting seed production, because plant maturity typically occurs when soil moisture is depleted for the growing season and root reserves are nearly exhausted from attempting seed formation. Mowing provides a longer window for defoliating plants because grazing time is limited by the protrusion of awns once the seedheads emerge.

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UC Integrated Pest Management Program Web site, http://www.ipm.ucdavis.edu/index.html.

UC Weed Research and Information Center Web site, http://wric.ucdavis.edu/information/information.html.

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Aegilops cylindrica Host.; jointed goatgrass
Aegilops triuncialis L.; barb goatgrass

Jointed goatgrass and barb goatgrass

Aegilops triuncialis

Family: Poaceae
Range: Jointed goatgrass is found in all western states. Barb goatgrass is found only in California and Oregon, primarily in northern California, especially the Central Valley foothills northward to southern Oregon. Both are expanding their distribution.
Habitat: Disturbed and undisturbed grasslands, oak woodlands, fields, rangelands, pastures, and roadsides. Barb goatgrass tolerates serpentine and hard, shallow, dry, gravelly soils but usually is not found in chaparral. Jointed goatgrass also infests grain fields, especially winter wheat.
Origin: Both species are native to Mediterranean Europe and western Asia.
Impacts: Plants have high silica content, resulting in a persistent thatch that can suppress other species. Barb goatgrass is late-maturing and drought-tolerant, enabling it to occupy and form monocultures in marginal environments. Tough seedheads with long barbed awns are inconvenient for humans and can injure livestock, even fatally. Jointed goatgrass joints are difficult to separate from wheat grains, and contaminated wheat harvests are reduced in quality and value.
Western states listed as Noxious Weed: *A. cylindrica*, Arizona, California, Colorado, Idaho, New Mexico, Oregon, Washington; *A. triuncialis*, California, Oregon
California Invasive Plant Council (Cal-IPC) Inventory: *A. triuncialis*, High Invasiveness

Jointed goatgrass and barb goatgrass are late-maturing winter annual grasses with spikes that resemble those of winter wheat. Both species can hybridize with wheat. Unlike wheat, goatgrass spikes break apart into hardened sections called joints.

Goatgrass plants grow up to 20 inches tall. Jointed goatgrass foliage looks similar to winter wheat, but blades, auricles, ligules, and leaf sheaths have evenly spaced, fine hairs along the margins. Barb goatgrass has gray-green foliage, spreading to erect, usually sparsely covered with fine hairs.

Goatgrass seedheads have spikelets arranged alternately along a zigzag rachis. The spikelets are large, hard, and cylindrical to cone-shaped, with long awns. Barb goatgrass, in particular, has stiff, barbed awns; mature seedheads break off whole and can work their way into fur or clothing. The goatgrasses go to seed later than most annual grasses, usually in late spring to early summer. Jointed goatgrass seedheads are 1 to 5 inches long, and barb goatgrass seedheads are 1 to 2.5 inches long. At maturity, heads turn reddish to purple and then dry to a straw color. Eventually the seedheads break apart into joints (spikelets attached to a piece of rachis). Once on the ground, the joints often can survive field burns because of their hard coat. The spikes and joints disperse by attaching to animals, humans, equipment or vehicles.

Seeds germinate in fall and winter, sometimes while still attached to the joints. In fact, joints often remain attached to the lower shoot of dug-up seedlings. Barb goatgrass seeds can remain viable for 2 years or more on the soil, while jointed goatgrass seeds can remain viable for 3 to 5 years.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking)	Hand pulling or hoeing small infestations is effective, if the roots are pulled and air-dried. Mowing can reduce seed production, but timing is critical. Mowing should occur after flowering, but before goatgrass seeds reach the soft boot stage. Early mowing will result in new tiller growth, and late mowing will only spread viable seed. Tillage may be used in certain situations. In agricultural fields, sweep tillage or V-blade tillage may be used during fallow periods. Conventional deep plowing will bury goatgrass seed beyond emergence depth. However, buried seed may be viable for up to 5 years, and secondary tillage may bring goatgrass seed back up to a successful

	emergence depth (< 5 in).
Cultural	Heavy grazing throughout the growing season and high intensity/short duration grazing periodically during the growing season appear to increase plant density. Both species mature later than most rangeland annual grasses, providing a window for controlling goatgrass seed production. It is important to burn before the joints disarticulate, to ensure seed kill. Burning will not effectively control seed on the soil surface. Goatgrass germination may increase the year after burning due to increased fertility and light penetration. Therefore, a second year management strategy must be incorporated, and the population should be monitored for several years. In rangeland, burning the first year followed by herbicide and spring seeding the second year may improve barb goatgrass control. For jointed goatgrass in winter wheat, burning fields after harvest can reduce germination of joints at the surface by 90% or more.
Biological	Naturally occurring bacterial strains that infect annual brome and jointed goatgrass, but have no effect on wheat, have been isolated in Kansas and Washington. These bacteria may soon be used in a bio-herbicidal approach for jointed goatgrass control in winter wheat. However, their utility in rangelands has not been explored.

CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

AROMATIC AMINO ACID INHIBITORS	
Glyphosate *Roundup, Accord XRT II*, and others	**Rate:** 1 qt product (*Roundup ProMax*)/acre for young plants < 6" tall (1.1 lb a.e./acre); 1.5 to 4 qt product (*Roundup ProMax*)/acre (1.7 to 4.5 lb a.e./acre) for larger plants or plants under stress. **Timing:** Postemergence in late winter to early spring. Apply to rapidly growing, non-stressed plants before flowering. If possible, apply before desirable perennials have emerged. According to label recommendations, seedling goatgrass can be selectively suppressed in pasture with 5 to 11 oz *Roundup ProMax* (or other trade name)/acre. **Remarks:** Glyphosate has no soil activity and is nonselective, so may kill desirable competitors. Its effectiveness is increased by addition of ammonium sulfate.
BRANCHED-CHAIN AMINO ACID INHIBITORS	
Imazapic *Plateau*	**Rate:** 4 to 6 oz product/acre (1 to 1.5 oz a.e./acre) **Timing:** Preemergence in fall or postemergence in early spring. **Remarks:** Mixed selectivity, tending to favor Asteraceae and some grasses. Safe for most native grasses, but higher rates may suppress seed of some cool-season grasses. Use lower rates for dry climates and low leaf litter and higher rates as moisture increases and/or leaf litter increases. Use methylated seed oil surfactant. Imazapic has long soil residual activity. Imazapic is not registered for use in California.
Propoxycarbazone-sodium *Canter R+P*	**Rate:** 1.2 oz product/acre (0.84 oz a.i./acre) **Timing:** Postemergence from the 2-leaf to 2-tiller stage when plants are growing rapidly. **Remarks:** Propoxycarbazone is a broad-spectrum herbicide that will control many species. It will provide only partial control of jointed goatgrass and perhaps barb goatgrass. Perennial grass species vary in tolerance. A non-ionic surfactant should be added at 0.25 to 0.5% v/v solution.
Sulfometuron *Oust* and others	**Rate:** 1.33 to 2 oz product/acre (1 to 1.5 oz a.i./acre) **Timing:** Preemergence or early postemergence in fall or in late winter after emergence but before goatgrass is 3 inches tall. **Remarks:** Sulfometuron has mixed selectivity. It is fairly safe on native perennial grasses, especially wheatgrass. Other desirable grasses may be stunted, stressed, or injured. Good for revegetation use. Should be used with a surfactant for early postemergence treatments. Sulfometuron has fairly long soil residual activity. Do not let spray drift onto sensitive crops. May move long distances in dry light windblown soils.
Sulfometuron + chlorsulfuron *Landmark XP*	**Rate:** 1.5 oz product/acre **Timing:** Preemergence, in fall or after soil thaws in spring. **Remarks:** See sulfometuron.

RECOMMENDED CITATION: DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States.* Weed Research and Information Center, University of California. 544 pp.

Fact Sheet

University *of* California
Agriculture and Natural Resources

Plumas-Sierra-Butte Livestock & Natural Resources

Perennial Pepperweed - *Brassicaceae Lepidium Latifolium*

Tom Getts - Weed Ecology and Cropping Systems Advisor- Lassen, Modoc, Sierra, and Plumas Counties and Tracy Schohr - Livestock and Natural Resources Advisor - Plumas, Sierra and Butte Counties

Pepperweed in flowering stage.

Pepperweed

Thick pepperweed roots.

Native to Eurasia, perennial pepperweed was thought to be introduced around 1900 to North America as a sugar beet seed contaminate. It is currently listed as noxious or problematic in 15 states, overtaking a variety of environments from wetlands and riparian areas to roadsides and agronomic crops. Typically, it is associated with moisture on the landscape, and will grow in saline or alkaline conditions.

Biology: It is a perennial species that once established grows in basal rosettes during the fall and spring until it bolts in early summer. Bolted plants grow from 3-6 ft. tall and produce small, numerous, showy white flowers. Seeds produced are small and not very persistent in the soil. Aboveground vegetation dies back in late summer, creating a litter layer up to 4 cm thick, which is problematic for competing vegetation. Roots are thick and course, growing up to 10 ft. deep.

Dispersal: Seeds of perennial pepperweed can be spread by wind, animals, humans and can even float in water systems. Once established, patches will expand rapidly by root growth. Where broken pieces of roots can also be a dispersion mechanism.

Impacts: Perennial pepperweed is known for creating monocultures crowding out desirable vegetation and displacing wildlife habitat. Not only is it problematic in natural areas, but it can be a major pest in pastures and crops. Perennial pepperweed also has the ability to alter soil properties, accumulating salts in the foliage, and corresponding litter layer. The thick litter layer it forms favors pepperweed's growth, while discouraging the growth of other plants. It often colonizes stream banks, which is problematic because it's coarse non-fibrous rooting system can be more prone to bank erosion than other vegetation. It is difficult to eradicate, and may decrease the overall value of the land it infests.

Control: Understanding the biology of the plant can help narrow down which control methods can be effective. When it is a seedling, before it's roots are established, many physical techniques, such as hand pulling, grubbing or cultivation, will control it. After it's roots are established, these methods can control the top growth, but will not kill the root below the soil surface without extensive repeated effort over many years. Single tillage events on agricultural land can be counterproductive, as they will chop up the root and spread them throughout the field increasing the size of the patch. Establishing competitive species, such as perennial grasses, can be a good cultural method to crowd out pepperweed. Livestock typically avoid eating perennial pepperweed, but will eat it during the younger growth stages which does not provide control of the roots.

Often herbicides alone or in combination with other tactics are needed to control the root system. The surface area of the leaves is maximized at the bud stage of growth, which research has shown is the best time to make herbicide applications. Likewise, mowing pepperweed at the bud stage, and allowing stems to regrow to the bud stage before herbicide application, can be a successful integrated strategy (mowing, and treating regrowth at the bud stage). Likewise, research has shown either high density stocking of cattle, cultivation, or prescribed fire, to remove the litter layer, can be effective when combined with herbicide applications.

Select Herbicides Herbicide Trade Name	Product Rate/A	Comments
2,4-D 2,4-D LV4 2,4-D Amine	2 qt./acre (1.9 a.e./acre)	Applications are most effective at the bud stage, right before flowering. It will not control Perennial pepperweed with a single application, but can suppress the population and provide good control with annual applications. 2-4,D will injure many broadleaf plants but typically is safe for application to grasses. This is a restricted use product in California, and is highly volatile at temperatures exceeding 80 degrees with potential for off site movement. 2,4-D Amine has an aquatic label, and can be used around water.
Glyphosate Roundup Glyfos Rodeo	2-4qt/acre (2.25-4.5 lb a.e./ acre)	Applications are most effective at the bud stage of growth, right before flowering. Glyphosate is non selective, and will kill most actively growing vegetation, creating a bare spot which may be colonized by other non-desirable vegetation. However, as glyphosate has no soil residual activity, it can be a good option when planning to seed into the treated area. Formulations of glyphosate without surfactants, can have an aquatic label.
Chlorsulfuron Telar	1-2.6 oz/acre (.75-1.96 oz a.i. /acre)	Applications are most effective at the bud stage of growth, right before flowering. Established perennial grasses are typically tolerant. Telar has long soil residual activity, and may prevent the germination of grasses and broadleaf plants. It may not be the best choice, in areas where grass plantings are planned after application. Telar cannot be used in water.
Imazapyr Arsenal Habitat	1-2 at./acre (0.5-1 lb a.e./ acre)	Applications are most effective at the bud stage of growth, right before flowering. Imazapyr is typically nonselective, and has a long residual activity. Only use this product where bare ground is acceptable for more than one year. Certain formulations can be applied around the water.

Any mention of pesticide is not a recommendation or endorsement of use by the University of California or the authors. Pesticides are mentioned by trade names for informational purposes only. Read and follow the label when using a pesticide.

Thick pepperweed litter in early spring.

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1.DiTomaso, J.M., G.B. Kyser et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California. 544 pp. (http://wric.ucdavis.edu/information/natural%20areas/wr_B/Bromus_diandrus-madritensis-tectorum.pdf)

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Fact Sheet

University *of* California
Agriculture and Natural Resources

Plumas-Sierra-Butte Livestock & Natural Resources

Spring 2019

Cheatgrass - *Poaceae Bromus Tectorum*

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Cheatgrass in alfalfa production.

Cheatgrass in Alfalfa Field.

Cheatgrass-fueled fire in sagebrush ecosystem.

Cheatgrass or Downy Brome (*bromus tectorum*) originated in Eurasia, and was thought to be introduced to north America around 1850 as a contaminate of grain seed. It has been described as the scourge of the west and is estimated to infest more than 100 million acres. It can grow to elevations of 13,000 ft. but is typically more problematic in elevations lower than 6,000 ft. Cheatgrass grows in rangelands, natural areas, roadsides, and is problematic in agronomic crops.

Biology: It is a winter annual species, which will germinate with the first fall rains, and can continue to germinate until early spring. It has a shallow fibrous root system, and will typically grow 6-24 inches tall depending on moisture. On rangelands it matures much earlier than native perennial grasses, and is one of the first species to dry out on the landscape. Soil seed life is not long, and is estimated to be approximately 2-3 years. Cheatgrass can form a thatch layer, which helps protect and shelter it's seedlings favoring their growth and survival.

Dispersal: Seeds of cheatgrass can be spread short distances by wind and water. Long distance dispersal is often attributed to animals, humans, and machinery. The seeds have short awns, which allow the seeds to become attached to clothing, hair and fur.

Impacts: Cheatgrass can be problematic in the natural landscape and in agronomic production. It is a highly competitive seedling, which can outcompete both perennial seedlings and annual crops. On the rangelands it has the ability to capture moisture and nutrients quickly in the spring, before perennial species start growth. Cheatgrass can also increase the frequency of the fire cycle in sagebrush, and forested ecosystems, drying out early in the year, providing the fine fuel needed to carry fire in-between native vegetation. Cheatgrass is nutritious to livestock for a short window in the spring, before seed head production occurs at which point they typically avoid grazing it if possible. Cheatgrass has always been a problematic weed species in agronomic production, competing with annual grain crops and perennial forage crops alike. It can be especially problematic in hay production, as the sharp seeds can get stuck in livestock mouths, causing physical injury and infection.

Control: As cheatgrass is an annual species, it only grows and disperses from seed. Preventing seed production for multiple years is the key to depleting the seedbank and favoring more desirable species. Mechanical methods work well to control cheatgrass - hand pulling or tillage can be an effective way to kill plants. However, cheatgrass has a long germination window, and physical techniques often create soil disturbance which can trigger more germination. No biological control agents have been released for cheatgrass. However, there are a few bacteria which have initially shown promise to reduce seedling vigor and growth. Various different herbicides can be used to control cheatgrass. The most effective herbicides are often the ones which have pre-emergence activity.

Select Herbicides		
Herbicide Trade Name	Product Rate/A	Comments
Hexazinone Velpar	2-6 pt./ acre. (0.5-1.5 lb a.i./ acre)	Good preemergence and post emergence activity. High rate can cause bare ground. Rate will need to be selected based on the crop safety, and other weed species present.
Metribuzin Dimetric	1/2 to 2/3 lbs/ acre (.375-.500 lb a.i./acre)	Good preemergence control of cheatgrass can be achieved in alfalfa and alfalfa grass mixtures in the intermountain region of California. Application should be made in the dormant season.
Indaziflam Esplanade	5-7oz / acre (1.04-1.46 oz a.i./acre)	Excellent preemergence actively, with no post emergence activity. Good perennial grass tolerance but no grazing label. Could be utilized for multiyear control where bare ground is acceptable.
Glyphosate Roundup Glyfos Rodeo	0.33- 1 qt./acre (.375-1.1 lb a.e./acre)	Cheatgrass is highly susceptible to glyphosate applications. Glyphosate will control actively growing cheatgrass, but will not control further flushes of seeds, because it does not have soil residual activity. It has been effective in controlling cheatgrass at low rates, when desirable perennial vegetation is dormant, and no green material is present on the desirable species.
Clethodim Select Max	6-8 oz / acre (1.5 to 2 oz a.i. / acre)	Applications are most effective when cheatgrass is in the seedling growth stage. Smaller actively growing plants are much easier to kill. Generally Clethodim is safe on broadleaf's species (including many crops), but will kill or injure most grasses. Only actively growing cheatgrass will be controlled, as clethodim does not have soil residual activity. (No range label)
Rimsulfuron Matrix	2-4 oz / acre (0.5-1oz a.i)	Will offer good preemergence to early postemergence control. It can offer good cheatgrass control in established perennial grasses, which are not actively growing. (Grazing restricted for one year)

Any mention of pesticide is not a recommendation or endorsement of use by the University of California or the authors. Pesticides are mentioned by trade names for informational purposes only. Whenever using a pesticide read and follow the label.

Cheatgrass seedlings in litter layer.

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Fact Sheet

University *of* California
Agriculture and Natural Resources

Plumas-Sierra-Butte Livestock & Natural Resources

Summer 2019

Musk Thistle - *Carduus nutans*

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Native to Eurasia, musk thistle was thought to be introduced to North America on the east coast in the mid 1800's possibly from ship ballast deposits. It is currently listed as noxious or problematic in 25 states as it can overtake a variety of environments from roadsides, grassland pastures and open areas. Typically, it is associated with disturbance, and thrives on fertile drained soils. Musk thistle is an A list noxious weed in California with limited populations and is required to be controlled.

Biology: It is a biennial thistle species that, in the first year after germination, grows as a basal rosette. In the second year it bolts, sending up a flowering seed stalk. Bolted plants typically reach heights from 3-5 feet tall, with large pink/purple flowers. A large individual plant can produce up to 20,000 seeds per plant with a soil seed life ranging from 3-10 years. Musk thistle can only reproduce and spread by seed.

Dispersal: Seeds are large, and attached to a pappus (white fluffy "parachute") for wind dispersal. However, it is estimated that only 5 percent of the seed remains attached to the pappus, and the majority of the seed falls to the ground, creating a patchy dynamic. Additionally, seeds can be spread by water, animals and machinery.

Impacts: Musk thistle can spread prolifically and have negative impacts on ecosystems and agriculture. It competes with desirable forage, and because of its spiny nature, livestock and wildlife rarely graze upon it. It has the ability to create a physical barrier, reducing use of the land by both livestock and wildlife. Like many invasive weeds, when left unmanaged it has the ability to take over and transform the landscape.

Control: Understanding the biology of the plant can help narrow down which control methods can be effective. As a biennial musk thistle only reproduces and spreads by seed, eliminating seed production is the key to musk thistle management. Like all weeds, when musk thistle is a seedling it is most susceptible to control techniques. Small plants can be much more easily targeted with physical or chemical control techniques than larger plants. Mechanical techniques (such as cultivation, hand pulling, or digging) can be effective if plants are severed at least two inches below the soil surface. Mowing can be used to suppress the plants when they are in flower before seed set, but will not eliminate seed set, and regrowth may occur. Goats may target musk with intensive grazing, but cattle typically tend to avoid grazing when possible. Competitive planting, and proper irrigation and fertilization of competitive grass species, will help crowd out thistles by eliminating space for them to succeed. There are numerous biological control agents establishing in North America, from the thistle head weevil, to the crown weevil, and musk thistle rust. While these biocontrol agents may suppress seed set, they will not often eliminate seed set, and cannot be relied upon in California where eradication of A list weed species is the goal. Chemical control options are often chosen for musk thistle control. Application to the rosette stage before bolting, are more effective than applications made to flowering plants. Broadcast applications of products with residual activity may give suppression for more than one growing season.

Select Herbicides		
Herbicide Trade Name	Product Rate/A	Comments
2,4-D 2,4-D LV4 2,4-D Amine	2 qt./acre (1.9 a.e./acre)	2,4-D can be applied to effectively control musk thistle rosettes and will not injure established grasses. It can be tank mixed with dicamba, aminopyralid, or triclopyr for more effective control of larger plants. 2,4-D alone will not provide any residual control of musk thistle seeds.
Aminopyralid Milestone	4-5 oz./acre (1-1.25 lb. a.e./ acre)	Aminopyralid can be applied as a pre-emergence application, up to emerged musk thistle plants in the flower bud stage for effective control. It will not impact established grasses, but there are haying restrictions. Broadcast applications of aminopyralid to patches of musk thistle rosettes can be an excellent way to target germinating seeds.
Clopyralid Transline	0.25-0.66 pt./ acre (1.5 to 4 oz. a.e./acre	Clopyralid can be applied from the seedling stage up until the flower bud stage to control musk thistle. It is safe on established grasses, and will provide some soil residual activity to target musk thistle seedlings. The maximum labeled rate for application in California is 2/3 pt./acre.
Chlorsulfuron Telar	1-2.6 oz./acre (.75-1.96 oz. a.e./acre)	Chlorsulfuron can provide good control of musk thistle seedlings and rosettes (with some residual activity). Applications to bolting plants may reduce seed set. Generally safe on established perennial grasses, chlorsulfuron will impact the ability to establish grasses after application.
Glyphosate Roundup Accord XRT	1.3-2.67 qt./ acre (1.5-3 lb. a.e./ acre)	Glyphosate will control musk thistle from the seedling stage up until the bud stage of growth. It is non-selective and will kill all green vegetation (including grasses) it comes into contact with. A good choice on roadsides and in farmyards, it is not the first choice in pastures, as bare spots after application maybe colonized by other non-desirable vegetation.

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Lythrum salicaria L.

Purple loosestrife

Family: Lythraceae
Range: Throughout the western United States, except Arizona. It is more prevalent in the Midwestern and northeastern states.
Habitat: Freshwater and brackish wetlands including marshes, riparian areas, lakeshores, floodplains, seasonally wet areas, intermittent streams, ditches and canals. It sometimes invades upland sites as well. Moisture is critical for establishment, but once established, purple loosestrife can survive for years at dry sites. Somewhat shade-tolerant and grows in most soil types, including infertile soils, but prefers slightly acid to neutral soils.
Origin: Considered to be native to Eurasia.
Impact: An extremely aggressive colonizer which disrupts the ecology of wetland sites by displacing native vegetation and wildlife. An isolated colony of purple loosestrife plants can spread to cover wetland sites in a single season under optimum growing conditions. Purple loosestrife can clog irrigation systems causing significant economic losses. The species has poor palatability and impacts the value of meadows and wetland pastures for grazing. Purple loosestrife is not considered a threat to cultivated crops.
Western states listed as Noxious Weed: Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming
California Invasive Plant Council (Cal-IPC) Inventory: High Invasiveness

Purple loosestrife is a perennial, aquatic herb that grows 3 to 7 ft tall, but can reach 10 ft under ideal conditions. It has a persistent taproot and spreading root stock with a dense bushy growth pattern. Plants start producing multiple stems from a single rootstock as early as the second year and can have more than 50 stems per plant. Established plants can have a crown 5 ft wide. Stems are erect and green to purple in color, with few branches, and are either 4- or 6-sided. The stalkless leaves are 0.75 to 4 inches long, 0.2 to 0.5 inch wide, sometimes with fine hairs. They can be opposite or whorled. The leaves are lance-shaped, rounded or heart-shaped at the base, clasping and with smooth margins. Shoots die each fall and new shoots develop the following spring from buds located at the top of the root crown.

Purple loosestrife has showy purple to magenta flowers, clustered on a spike a few inches to 3 ft long. The seed capsule has two cells with numerous tiny reddish-brown seeds (1 mm long or less). Seed production per plant ranges from around 100,000 seeds for young plants to over 2.7 million seeds for established plants. Seeds are dispersed by water and to a lesser degree by wind. Seeds can germinate underwater, and their longevity is at least 3 years. While sexual reproduction by seed is most important, purple loosestrife can also spread vegetatively from stem cuttings. Buried stems have adventitious buds that can produce new shoots or roots.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking)	Manually digging or hand-pulling is effective for early infestations to help prevent the establishment of dense colonies. Early detection and removal is essential because established plants are too large and deep-rooted to remove easily. All plant material, especially the root crown, should be removed to prevent resprouting. Pulled plants should be dried or burned. Repeat visits are important to ensure there is no regrowth. Mowing purple loosestrife can be impractical due to the sites it occupies. Mowing or cutting stems can help

	reduce seed bank accumulation. Late-season cutting was found to reduce shoot production to a greater degree than mid-summer cutting. Mowing or cutting may be more effective when used as part of an integrated approach with herbicides. Tillage is probably not an effective control measure for purple loosestrife. Wetland sites where it grows are not conducive to tillage operations. In addition, any disturbance that fragments live stem or root tissue is likely to spread purple loosestrife, and its extensive soil seedbank is likely to reinvade open areas created with tillage. Three to four consecutive years of tillage might be effective.
Cultural	Purple loosestrife grows in wet areas that are not usually grazed and it has poor palatability. There is little information on the effectiveness of fire, but some sources indicate that purple loosestrife does not burn well and it would be difficult to get a fire to carry through an infested area. Additionally, it is doubtful that burn temperatures in wetland areas would get high enough to kill the massive crown. However, burning removes biomass and may improve the effectiveness of herbicides. Continuous flooding has been somewhat effective for large infestations where the water level can be controlled. The duration of the flooding appears to be more important than the depth of flooding. The precise parameters for maximum effectiveness need further study. Black plastic mulch was found to be marginally effective, but while it can reduce growth and seed production, it does not kill the roots of mature plants.
Biological	Several non-native insects have been released in the United States to control purple loosestrife. These include the black-margined and golden loosestrife beetles (*Galerucella calmariensis* and *G. pusilla*), whose larvae and adults feed on the foliage and flowers, reducing seed production. In addition, the larvae and adults of the root weevil (*Hylobius transversovittatus*) feed on the root. Larvae of the loosestrife flower weevil (*Nanophyes marmoratus* and *N. brevis*) feed on flowers, and the adults feed on foliage and flowers. The two *Galerucella* spp. have been the most successful of these biocontrol agents. These beetles were released between 1992 and 1994 and have become established in some states. They are not present in California yet but have shown promising results in Oregon. The root weevil and the flower weevil have been released at test sites in California with mediocre results. There is ongoing research on the use of pathogenic fungi as biocontrol agents for purple loosestrife.

CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

GROWTH REGULATORS	
Triclopyr *Garlon 3A*	**Rate:** Broadcast foliar treatment: 6 to 8 qt *Garlon 3A*/acre (4.5 to 6 lb a.e./acre). Spot treatment: 1.5 to 2% v/v solution **Timing:** Postemergence at bud to mid-flowering stage. **Remarks:** Thorough coverage and a minimum of 50 gal/acre spray solution is recommended. Follow-up applications should be made to regrowth the following year. Triclopyr is broadleaf-selective and safe on most grasses. It is most effective on smaller plants and has little or no residual activity. *Garlon 3A* and other amine formulations are registered for aquatic use. Triclopyr (1 to 2 qt *Garlon 3A*/acre) can be mixed with aminopyralid (*Milestone*) at 7 oz product/acre or with 1 to 2 pt product/acre 2,4-D.
AROMATIC AMINO ACID INHIBITORS	
Glyphosate *Roundup*, *Rodeo*, *Aquamaster*, and others	**Rate:** Broadcast foliar treatment: 1 to 2 pt product (*Roundup ProMax*)/acre (0.56 to 1.1 lb a.e./acre). Spot treatment: 1% v/v solution **Timing:** Postemergence to rapidly growing plants in the full to late flowering stage. Seedlings may be treated in spring following a fall treatment. **Remarks:** Nonselective, no soil activity. Effectiveness is increased by addition of ammonium sulfate. Aquatic registered formulations, e.g., *Rodeo* and *Aquamaster*, are available for use close to water.
BRANCHED-CHAIN AMINO ACID INHIBITORS	
Imazapyr *Arsenal*, *Habitat*,	**Rate:** 1 to 2 pt product/acre (4 to 8 oz a.e./acre) **Timing:** Postemergence to rapidly growing loosestrife after mid-bloom until killing frost.

Stalker, Chopper, Polaris	**Remarks:** Nonselective, long soil residual activity. Leaves more bare ground than other treatments, even a year after application. *Habitat* is an aquatic registered formulation available for use close to water.
Metsulfuron *Escort*	**Rate:** 1 to 2 oz product/acre (0.6 to 1.2 oz a.i./acre) **Timing:** Postemergence from seedling to flowering stage. Most effective at flower-bud and flowering stage. **Remarks:** Primarily active on broadleaf species. Always use a surfactant. It can be tank-mixed with 2,4-D for quicker burndown. Other premix formulations of metsulfuron can be used at similar application timing. These include *Cimarron Max* (metsulfuron + dicamba + 2,4-D) and *Cimarron X-tra* (metsulfuron + chlorsulfuron). Metsulfuron is not registered for use in California.

RECOMMENDED CITATION: DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES
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How to Manage Pests

Pests in Gardens and Landscapes

Yellow Starthistle

Revised 9/07 Download PDF

In this Guideline:

Yellow starthistle, *Centaurea solstitialis*, is native to Eurasia and was introduced to California around 1850 via South America. It is now common in open areas on roadsides, rangeland, wildlands, hay fields, pastures, and waste areas. Recent reports indicate that yellow starthistle infests between 10 and 15 million acres in California. Disturbances created by cultivation, poorly timed mowing, road building and maintenance, or overgrazing favor this rapid colonizer. It forms dense infestations and rapidly depletes soil moisture, thus preventing the establishment of other species. It is also poisonous to horses, causing a nervous disorder called "chewing disease" (nigropallidal encephalomalacia), which is fatal once symptoms develop. Horses are the only animal known to be affected in this manner and should not be allowed to graze on yellow starthistle.

Yellow starthistle, *Centaurea solstitialis*.

IDENTIFICATION

Yellow starthistle is a gray-green to blue-green plant with a deep, vigorous taproot. It produces bright, thistlelike yellow flowers with sharp spines surrounding the base. Yellow starthistle grows to heights varying from 6 inches to 5 feet. The stems of mature plants are rigid, spreading, and typically branching from the base in open areas. Stems and leaves are covered with a loose, cottony wool that gives them a whitish appearance. Stems appear winged due to leaf bases that extend beyond the nodes. Basal leaves are 2 to 3 inches long and deeply lobed. Upper leaves are short (0.5 to 1 inch long) and narrow with few lobes.

BIOLOGY

Yellow starthistle is a long-lived winter annual that is usually found below 7,000 feet elevation in dry, light-intensive areas where average annual rainfall is between 10 and 60 inches. Seed output can be as high at 30,000 seeds per square meter, with about 95% of the seed being viable soon after dispersal. Most seeds germinate within a year of dispersal, but some can remain viable in the soil for more than 3 years.

Yellow starthistle seeds germinate from fall through spring, which corresponds to the normal rainy season in California. After germinating, the plant initially allocates most of its resources to root growth. By late spring, roots can extend over 3 feet into the soil profile, although the portion above ground is a relatively small basal rosette. This allows yellow starthistle to out-compete shallow-rooted annual species during the drier summer months when moisture availability is limited near the soil surface. It also helps explain why yellow starthistle survives well into the summer, long after other annual species have dried up, and why it can regrow after top removal from mowing or grazing.

The competitive ability of yellow starthistle also depends on light intensity at the soil surface during the seedling and rosette stages of development. Yellow starthistle proliferates at high light intensity and does poorly in low light. High light conditions often occur along roadsides, in disturbed sites, grasslands, and on south-facing slopes at higher elevations.

Yellow starthistle flower.

Seedling of yellow starthistle, *Centaurea solstitialis*, at the cotyledon stage.

Seedling of yellow starthistle.

Damage to a starthistle seed head by *Bangasternus orientalis*.

MANAGEMENT

Control of yellow starthistle cannot be accomplished with a single treatment or in a single year. Effective management requires control of the current population and suppression of seed production, combined with establishment of competitive, desirable vegetation.

Prevention

Yellow starthistle proliferates along roadsides. Invasion by this weed may be increased with disturbances created by road building and maintenance. Seeds are often spread by vehicles or with the transportation of livestock or contaminated soil. Survey roadsides for the presence of this weed and immediately control new infestations to prevent seed production and its subsequent spread.

Yellow starthistle also can be spread as a contaminant in grass seed. Only certified seed should be used for range or pasture seeding. Seed may also come as a contaminant in all classes of hay, particularly grass hay. Carefully check hay shipments for evidence of yellow starthistle. Hay used as mulch along roadsides or disturbed areas can be a source of yellow starthistle introduction. When feeding hay is suspected of containing yellow starthistle, place bales in one area and periodically check around feeding areas for signs of starthistle seedlings. Livestock that have fed in yellow starthistle-infested areas should not be pastured or shipped to uninfested areas. Control newly emerged seedlings to prevent establishment. It is important to control new infestations when they are small because spot eradication is least expensive and most effective at this time.

Biological Control

Four natural enemies of yellow starthistle have been imported from Europe and by 2003 were well established in California. These biological control agents include two weevils *(Bangasternus orientalis* and *Eustenopus villosus)* and two flies *(Urophora sirunaseva* and *Chaetorellia succinea)*. They all attack the flower/seed head and directly or indirectly reduce seed production, the only means of reproduction and spread of the weed. The insects lay their eggs in, on, or near flower/seed heads and complete their development within them. *Eustenopus villosus* adults also directly reduce seed production by feeding on immature flower heads. All of these insects are highly host-specific to yellow starthistle and do not attack commercially valuable crops or native plants.

These insects already occur in most areas of California that are infested with yellow starthistle. If additional releases of these natural enemies are made, protect the release area from practices that may damage the insects. Such practices include insecticide applications, soil cultivation, summer-prescribed burning, or mowing when the plants are in the flowering stage. After establishment, the insects are capable of building up to high numbers and spreading on their own. These insects do best in areas with warm, dry summer climates.

The most recent releases, *Eustenopus villosus* and *Chaetorellia succinea,* have proven to be the most effective agents for yellow starthistle seed suppression. These insects are becoming more widespread throughout the state. However, they only suppress yellow starthistle seed production by about 50%, so they should not be considered as the sole method of control. It is possible that a combination of herbicides and biologicial control will provide more sustainable control than either technique used alone. Landowners and managers with yellow starthistle problems may contact their county agricultural commissioner's office about obtaining these biological control insects.

Most recently a rust, *Puccinea jaceae* var. *solstitialis*, was approved for release in California. Trials are under way to determine the potential effectiveness of this organism on yellow starthistle.

Cultural Control

Yellow starthistle begins emergence with fall rains and continues to germinate throughout the rainy season. A single cultivation after the rainy season when soils are dry effectively controls yellow starthistle seedlings and rosettes. This treatment must be made after the last rains but before seeds are produced. If cultivation is carried out too early (e.g., before the last rains) seed will continue to germinate and another cultivation will be needed to control each new flush of seedlings that results from a spring rain.

Mowing can be used to manage yellow starthistle, provided it is well timed and used on plants with a high branching pattern. Mowing early growth stages results in increased light penetration and rapid regrowth of the weed. If plants branch from near the base, regrowth will occur from recovering branches. Repeated mowing of plants too early in their life cycles (rosette or bolting stages) or when branches are below the mowing height will not prevent seed production, as flowers will develop below the mower cutting height. Plants with a high branching pattern are easier to control, as recovery will be greatly reduced. Even plants with this growth pattern must be mowed in the late spiny or early flowering stage to be successful. An additional mowing may be necessary in some cases.

To encourage growth of desirable vegetation, let these species set seed before mowing, but be sure to mow well before starthistle is in full flower. In general, mowing is most effective when soil moisture is low and no irrigation or rainfall follows mowing.

Grazing is effective in reducing yellow starthistle seed production. Sheep, goats, or cattle eat yellow starthistle before spines form on the plant. Goats will eat starthistle even in the spiny stage. The plant's crude protein concentration is variable, but ranges from 28% at the rosette stage down to 11% at the bud stage and should be sufficient to meet the general maintenance requirements for most ruminants. When it is abundant, yellow starthistle appears to have the ability to sustain animals several weeks beyond annual grass "dry down." Intensive grazing in late May and June using large numbers of animals for short duration can reduce plant height, canopy size, and seed production. Avoid overgrazing, however; do not allow more than half the grass forage to be removed. Grazing more than this will reduce the grasses' recovery rate and ability to shade out yellow starthistle.

Burning is best performed at the end of the rainy season when flowers first appear. Yellow starthistle should be green at this time and will require desiccated vegetation to burn. Most annual vegetation other than yellow starthistle, particularly grasses, should have dried and shed their seeds by this time. The foliage of these plants serves as a fuel source to allow a more complete burn. Burning for 2 or more consecutive years helps suppress yellow starthistle and deplete the soil seedbank. Burning can also increase the recovery and density of perennial grasses. Burning can damage biological control agents, but insects from adjacent areas will readily move back into the site the following year.

Revegetation

Control practices are capable of reducing yellow starthistle populations, but in the absence of competition, starthistle will often reestablish. Effective management requires that desirable plant species be encouraged or planted and managed to prevent yellow starthistle germination or growth. Species choice for revegetation will depend on the intended use of that site. Resident vegetation such as perennial bunchgrasses or wildflowers may be desirable along roadsides, abandoned pastures, or in rangelands and wildlands. In these situations, cultural, biological, or chemical methods can be used to reduce yellow starthistle while encouraging other plant species, if possible, with practices such as fertilization. Research efforts to reestablish native perennial grasses are in progress. Perennial grasses are slow to establish and may require herbicide treatments to assist yellow starthistle or annual grass control during establishment, but once well established, alternative controls such as properly timed grazing, mowing, or burning can be used effectively.

In pastures, eliminate dense stands of yellow starthistle and reseed the area with a fast-growing, competitive forage species. Although annual legumes work well for this purpose, the lack of selective herbicides makes follow-up treatments difficult. Therefore, grasses are best because selective herbicides can then be used to control yellow starthistle plants not eliminated by grass competition. In areas with scattered yellow starthistle infestations, eliminate scattered plants and overseed with a desirable species to provide enough competition to prevent yellow starthistle from reestablishing.

In all instances, choose desirable species that are well adapted to the site and not likely to become invasive themselves. Species that grow well are the best competitors.

Chemical Control

Both postemergent and preemergent herbicides are available to control yellow starthistle along roadsides, rights-of-way, and noncrop areas. Most herbicides registered for use in rangeland and pastures are only active postemergence. Clopyralid, however, has both preemergence and postemergence activity on yellow starthistle.

Postemergent Herbicides

Postemergent herbicide treatments generally work best on seedlings. The long germination period of yellow starthistle makes control with a single application almost impossible. A treatment following the first flush of seedlings opens a site up for later flushes. Waiting until later in the rainy season to apply a postemergent herbicide allows a greater number of seedlings to be treated, but larger plants will require higher herbicide rates and may not be controlled.

Aminopyralid and *clopyralid* are growth regulator herbicides for use in noncrop areas, including rangeland and pastures. Unlike other growth regulator herbicides, these are effective on yellow starthistle both postemergence and preemergence. The most effective timing for aminopyralid application is from December to March, when yellow starthistle is in the seedling to midrosette stage; its soil residual should last until the end of the rainy season. Clopyralid has a shorter soil residual and should be applied January to March. For both chemicals, earlier applications (i.e., in fall) may not provide full-season control, and later applications (bolting to early spiny stage) will require higher rates. A single application at the recommended time will provide season-long control. Aminopyralid is used at 0.75 to 1.75 oz acid equivalent/acre, and clopyralid is used at 2 to 3.96 oz acid equivalent/acre. Both chemicals are selective on many members of the sunflower family, particularly thistles, but can also injure legumes, including clovers. Most other broadleaf species and all grasses are not injured. There are no grazing restrictions after aminopyralid or clopyralid use in rangelands. While not registered for use around the home, aminopyralid and clopyralid do have registration for use in pastures, rangelands, rights-of-way, roadsides, and other noncrop areas. Clippings from treated areas should not be used as compost; these herbicides degrade slowly in compost and can be a problem when used as a mulch or fertilizer source in sensitive crops or landscapes.

2,4-D can provide acceptable control of yellow starthistle if it is applied at the proper rate and time. Treatment in the rosette growth stage provides better control than later applications. Amine formulations are as effective as ester formulations at the small rosette growth stage, and amine formulations reduce the chance of off-target movement.

Application rates of 0.5 to 0.75 lb active ingredient/acre will control small rosettes. Applications made later in the season, when rosettes are larger or after bolting has been initiated, require a higher application rate (1 to 2 lb active ingredient/acre) to achieve equivalent control. 2,4-D is a growth regulator and a selective herbicide that controls many other broadleaf plants, but has minimal effect on clovers and generally does not harm grasses. It has little, if any, soil activity. Drift from 2,4-D applications is common, particularly from ester formulations. Use caution when applying near sensitive vegetation or during windy or high temperature conditions. Certain formulations of 2,4-D require a restricted materials permit; generally formulations that are sold in small quantities (i.e., liquid formulations that do not exceed 1 quart and dry formulations that do not exceed 1 pound) do not require a permit.

Dicamba is very effective at controlling yellow starthistle at rates as low as 0.25 lb active ingredient/acre. When yellow starthistle rosettes are small, about 1 to 1.5 inches across, the 0.25 lb active ingredient/acre rate works well, but higher rates (0.5 to 0.75 lb active ingredient/acre) are needed if plants are larger. Applications made in late rosette to early bolting stages have provided excellent control, although earlier treatments are better.

Dicamba is also a growth regulator and selective herbicide that controls many broadleaf plants, including clovers, but does not harm grasses. Its soil activity is very short. Like 2,4-D, it is available as both an amine and as an ester formulation. Drift from dicamba applications is common, especially from the ester formulation. Some formulations have lower drift potential than others. Use caution when applying near sensitive vegetation. Certain formulations of dicamba require a restricted materials permit; generally formulations that are sold in small quantities (i.e., liquid formulations that do not exceed 1 quart and dry formulations that do not exceed 1 pound) do not require a permit.

Triclopyr at 0.5 lb active ingredient/acre provides complete control of yellow starthistle seedlings but is not as effective on larger plants. More mature plants require rates up to 1.5 lb active ingredient/acre. Like 2,4-D and dicamba, triclopyr is a growth regulator herbicide with little or no residual activity. It is foliar-absorbed and active on broadleaf species, including clovers, but typically does not harm grasses. Triclopyr is formulated as both an amine and ester. The ester formulation is more sensitive to drift than the amine form. Caution should be observed when using the ester formulation. This material is registered for use around the home as well as for pastures, rangelands, rights-of-way, roadsides, and other noncrop areas.

Glyphosate controls yellow starthistle at 1 lb active ingredient/acre. Good coverage, clean water, and actively growing yellow starthistle plants are all essential for adequate control. Unlike growth regulator herbicides, glyphosate is nonselective and controls most plants, including grasses. It has no soil activity. A 1% solution of glyphosate also provides effective control and is used at this concentration for spot treatment of small patches. An application of glyphosate is a very effective method of controlling starthistle plants in the bolting, spiny, and early flowering stages at 1 to 2 lb active ingredient/acre. However, glyphosate will severely damage desirable perennial grasses if they are sprayed as well. Glyphosate is registered for use around the home as well as for pastures, rangelands, rights-of-way, roadsides, and other noncrop areas.

Preemergent Herbicides

Preemergent herbicides must be applied before seeds germinate to be effective. The long germination period of yellow starthistle requires that a preemergent material have a lengthy residual activity. Make applications before a rain, which will move the material into the soil. Because these materials adhere to soil particles, off-site movement and possible injury of susceptible plants could occur if the soil is dry and wind occurs before rain. When yellow starthistle plants have already emerged, it is possible to combine a postemergent herbicide (to control emerged plants) with a preemergent herbicide (to provide residual control of any subsequent germination) for an effective control strategy.

Chlorsulfuron and sulfometuron are preemergent herbicides registered for roadsides and other noncrop uses. Chlorsulfuron was recently registered for use in rangelands. Both are very effective at controlling yellow starthistle when applied at 1 to 2 oz active ingredient/acre. Little postemergence activity occurs on yellow starthistle with these two compounds. Best control is achieved when applications are made before weeds emerge. They may not be used around the home.

Integrated Approaches

Combinations of prescribed burning and clopyralid can be very effective for yellow starthistle control. However, when using this integrated approach it is important that a prescribed burn be conducted the first year (or possibly for 2 years) and that clopyralid be applied in the last year of the program. Treating in the first year and burning in the second year may increase the starthistle problem because burning has been shown to increase seed germination during the following rainy season. Continued control of yellow starthistle after the last year of treatment can be accomplished by either mowing, spot spraying, or hand-pulling.

WARNING ON THE USE OF PESTICIDES

ACTIVE INGREDIENTS Compare risks

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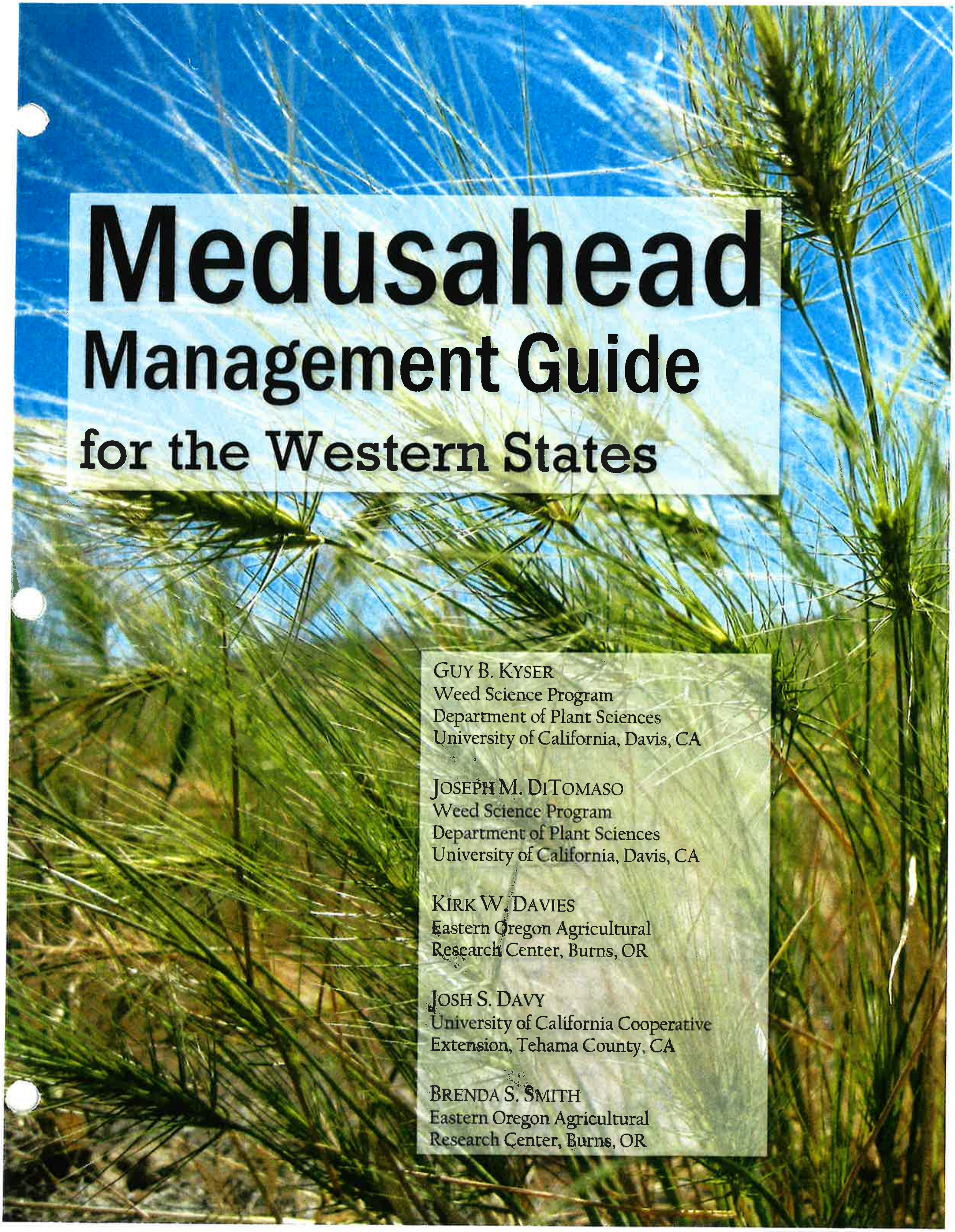

Medusahead Management Guide for the Western States

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Uncredited photographs are by J.M. DiTomaso.

Chapter 1: Introduction and Spread

Origins

Figure 1. Medusahead's center of origin
(Image: Google Earth)

Medusahead (*Taeniatherum caput-medusae*) is native to the Mediterranean region (Figure 1). Currently, three subspecies surround the Mediterranean from Spain to Morocco, and northeast into Eurasia (Frederiksen 1986; Major 1960).

Medusahead is a member of the Triticeae, a tribe of grasses which includes the important grain crops wheat (*Triticum* spp.), barley (*Hordeum* spp.), and cereal rye (*Secale* spp.), as well as wheatgrasses (*Agropyron* and *Thinopyron* spp.), wildryes (*Elymus* and *Leymus* spp.), and goatgrasses (*Aegilops* spp.). This grass tribe has its likely center of origin in the Middle East. There is evidence that some types were used for human food 23,000 years ago (Weiss et al. 2004); wheat, barley, and rye, of course, formed the basis for early agriculture and human settlement.

Like many weeds from this part of the world, it is likely that medusahead accompanied agriculture from the earliest days. Medusahead spikes have been found in 9,000-year old storage jars from the Neolithic town of Çatalhöyük, in central Turkey, alongside jars of primitive cultivars of wheat and barley (Fairbairn et al. 2007; Helbæk 1964). Helbæk commented, "What the ancient people wanted them for is impossible to guess."

Introduction to North America

Medusahead was first recorded in the United States near Roseburg, Oregon, in 1887 (Howell 1903). Herbarium records indicate that the plant spread concentrically – north into Washington, south into California, and east into the Great Basin, Idaho, and other western states (Figure 3) – but most rapidly in the direction of California (Major et al. 1960). Recent genetic analysis suggests that at least seven distinct genotypes of medusahead have been introduced over a timespan from 1887 to as recently as 1988, and that the plant has more genetic diversity here than previously thought (Novak and Sforza 2008).

It is not known how medusahead was introduced to the United States. It has been suggested that medusahead arrived as a contaminant in cereal grain seed, while others (George 1992; Hilken and Miller 1980) suggest it may have arrived clinging to the fur of imported livestock. Because medusahead seeds are smaller than most cereal grains, and because this plant goes to seed later than most domesticated cereals, the fur hypothesis seems most likely. In addition, during its subsequent spread from the point of introduction, medusahead has been strongly associated with areas of livestock production. For example, in the 1960s isolated populations were found in the eastern Sierra Nevada in areas used to corral sheep (Young 1992).

Spread and Distribution

Once introduced to the western US, medusahead spread rapidly in low-elevation annual grasslands, oak woodlands, and chaparral communities (Young 1992). These west coast communities have a Mediterranean-type climate comparable to medusahead's native region: hot and dry in summer, and cool and moist from late fall through spring. Mediterranean

Figure 2. County distribution of medusahead

Locations reported by EDDMapS and CalFlora. Star indicates location of first detected occurrence.

winter annuals such as medusahead generally germinate in fall and flower and set seed in spring.

Medusahead invaded the intermountain region, east of the Sierra and Cascade ranges, at a much slower rate. It was first reported in this region at Verdi, Nevada, in the early 1960s (Young 1992). Medusahead is somewhat moisture-limited in the Great Basin and appears to favor clay soils (Dahl and Tisdale 1975). Where established, however, it has the potential to outcompete downy brome (*Bromus tectorum*, also called cheatgrass) (Hironaka 1994).

It continues to expand its range by about 12% per year and recently was estimated to infest over 2.4 million acres (950,000 ha) in the 17 western states (Rice 2005). In California, medusahead now occupies more than a million acres of annual-dominated grassland, oak woodland, and chaparral communities (Duncan et al. 2004). It is found almost statewide, except for the high Sierra and the southern deserts (Jepson eFlora 2014). In Idaho and Oregon, rangeland infested with medusahead approximately doubled in the last 40 years of the 20th century (Davies and Johnson 2008). This weed is now found in almost every Oregon county, in most of western and southern Idaho, eastern Washington, and northern Nevada. It occurs in patches in Utah and Arizona and has recently been reported in the eyebrow of Montana. Medusahead is a state-listed noxious weed in California, Colorado, Nevada, Oregon, and Utah.

Mechanisms of Spread

Hooks, barbs, and awns are common adaptations in seeds transported by animals (Shmida and Ellner 1983; Sorensen 1986). Medusahead seeds are small, with long awns barbed with silica scales. These seeds are well suited for attaching to animal fur, clothing, vehicles, and machinery. It is thought that medium-range dispersal of medusahead is primarily by travel in coats of livestock (Figure 3). The seeds do not appear to be stashed by rodents (Longland 1994) or used by birds (Goebel and Berry 1976).

Long-range dispersal – for example, the introduction of medusahead to North America, or movement from lowland pastures to the intermountain region – is probably always abetted by human activity. Dissemination might occur by seeds attaching to clothing or vehicles (Figure 4) or to livestock being trucked to seasonal grazing sites. In a survey of medusahead distribution in southeastern Oregon, Davies et al. (2013) found that infestations were concentrated along travel routes.

Figure 3. Seeds attach readily to cattle
(Photo: Erica Spotswood, UC Berkeley)

Figure 4. Seeds move with human activity
Medusahead and other awned invasives can attach to clothing. (Photo: Erica Spotswood, UC Berkeley)

Chapter 2: Impacts

In both lowland rangelands and in high-elevation semiarid systems, medusahead is considered to be an ecosystem transformer species (Richardson et al. 2000; Wells et al. 1986). This places it among the worst weeds: not only does medusahead compete for resources with more desirable species, but it changes ecosystem function to favor its own survival at the expense of the entire ecosystem.

Displacement of natural vegetation has substantial impacts on the structure, organization and functioning of ecosystems. Loss of native plant species can permanently change nutrient and hydrologic cycles and accelerate erosion (Olson 1999). The costs of lower productivity and the increased costs of managing medusahead can have effects far beyond the ranch gate, often having a negative impact on rural economies.

Forage and Habitat

Medusahead foliage has poor palatability owing to a high silica content (approximately 10% dry weight) (Bovey et al. 1961; Hironaka 1994) and a rough tex-

Figure 5. Medusahead on foothill rangeland
Medusahead can develop into monotypic stands that limit the establishment of desirable rangeland species.

Figure 6. Greater sage grouse
Centrocercus urophasianus. *(Photo: Pacific Southwest Region US Fish and Wildlife Service)*

ture (George 1992; Lusk et al. 1961). Due to the high silica content, particularly once seed is set (Murphy and Turner 1959), medusahead is of little value in livestock production and wildlife habitat. Furthermore, mature medusahead seeds have long, stiff, sharp, barbed awns, which discourage seed predation. As with downy brome, these spiny awns can injure mouth and throat tissues of grazing animals, causing reductions in feed intake and weight gain (Currie et al. 1987).

As forage, composition of medusahead is comparable to many desirable forage species in moisture content, crude protein, crude fat, crude fiber and lignin (Bovey et al. 1961). However, its palatability is limited, especially as it matures.

Because grazing animals selectively avoid this plant, and because medusahead thatch tends to suppress desirable forage species (see below), infestations often develop into near-monotypic stands (Figure 5). Dense medusahead infestations can reduce grazing capacity on rangelands by 75% to 80% (Hironaka 1961; George 1994).

Medusahead figures heavily in habitat degradation across the range of sage grouse (*Centrocercus* spp.) (Figure 6) in the intermountain region. Medusahead displaces sagebrush, forbs, and perennial bunchgrasses, and contributes to an altered fire regime (Knick and Connelly 2011). In undisturbed habitat, sage grouse feed on leaves of sagebrush and forbs, and find shelter under sagebrush and other shrubs. Invasive annual grasses such as medusahead are one of the main identified threats to the sagebrush steppe ecosystem. The medusahead threat to this iconic species has given impetus to regional management coalitions such as the USDA-funded Ecologically-Based Invasive Plant Management (EBIPM) program.

Medusahead seeds are less used by seed-eating birds than other grasses, even downy brome (Goebel and Berry 1976). Native seed-eating rodents also prefer seeds of other species, tending to avoid medusahead-infested areas (Longland 1994). Consequently, the effects of a medusahead infestation are felt throughout the faunal community.

Thatch

The high silica content in medusahead foliage not only discourages grazing but also retards decomposition of senesced plants (Bovey et al. 1961; Hironaka 1994). As a result, the old stalks and foliage of medusahead often build up into a thick, persistent thatch layer (George 1992; Young 1992) (Figure 7). Medu-

Figure 7. Medusahead thatch
This thick blanket of old medusahead material forms a mulch which prevents establishment of other plant species. (Photo: Gilbert DelRosario, Dow AgroSciences)

sahead is adapted to germinating and establishing through its own thatch.

At the same time, this thatch reduces light penetration to the soil surface, inhibiting germination of seeds of plant species which require light stimulation. Seeds of large-seeded species may be prevented from reaching the soil, e.g., blue oak in California (Borchet et al. 1989); smaller seeds may not contain sufficient resources to sustain growth of a shoot through the litter layer. The thatch delays soil warming in spring and ties up nutrients. Thus, a thick medusahead litter layer physically suppresses germination, establishment, and survival of other rangeland species (Bovey et al. 1961; Brannon 1972; Evans and Young 1970; Harris 1977; Young 1992; Young et al. 1971).

In Great Basin sagebrush steppe communities, medusahead infestations are correlated with reduced diversity, richness, abundance, and biomass of native plant species and functional groups (Davies 2011; Davies and Svejcar 2008; HilleRisLambers et al. 2010). Young (1992) hypothesized that medusahead litter accumulation was the greatest threat to plant biodiversity in the Great Basin (Figure 8).

Fire Cycles

In semiarid big sagebrush (*Artemisia tridentata*) steppe, medusahead acts as a fire promoter (Brooks

Figure 8. Medusahead at high elevations

This Oregon steppe habitat is at risk of conversion to exotic annual grassland. (Photo: David Bohnert, Eastern Oregon Agricultural Research Center, Burns, OR) et al. 2004) in a manner similar to downy brome in more arid parts of the Great Basin (Brooks and Pyke 2001; D'Antonio and Vitousek 1992; Torell et al. 1961). Like downy brome, medusahead fills in between the sagebrush, creating a continuous fuel corridor that accelerates the fire cycle. Areas in the Great Basin dominated by downy brome have an average fire return interval of 50 to 80 years, compared to fire return intervals of ~200 years on native sagebrush steppe (Balch et al. 2013). The persistent thatch accompanying medusahead infestations may pose a risk of fire in any season.

Unlike many low-elevation shrub species, many species of sagebrush are unable to regenerate from more frequent fires. This change in fire frequency rapidly degrades the ecosystem from a native shrub community to predominantly nonnative annual grassland. In addition, increased fuel accumulation from annual grass infestations increases the rate of fire-induced mortality of perennial grasses (Davies et al. 2009). As a secondary impact, this contributes to the decline of sagebrush-dependent wildlife species such as sage grouse (Davies and Johnson 2008).

Resource Consumption and Competition

Medusahead competes for water and nutrients with annual and perennial grasses, particularly while perennial grasses are establishing from seed (Clausnitzer et al. 1999; Harris 1977; Harris and Wilson 1970; Hilken and Miller 1980; Young and Mangold 2008). In the Great Basin, medusahead is even able to displace downy brome, an invasive early-season annual grass, on sites where there is still soil moisture available after downy brome matures, e.g., on clay soils (Hironaka 1961).

The buildup of persistent thatch ties up soil nutrients, making them unavailable to other plant species (Brannon 1972; Facelli and Pickett 1991). In addition, there is some evidence that this litter has allelopathic effects, i.e., leaches chemicals which suppress germination of other plant species (Zhang et al. 2010b).

In comparing soils from medusahead-infested sites in Lassen County, CA, with uninfested sites, Trent et al. (1994) found reduced nitrogen mineralization, reduced total nitrogen, and significantly increased soil pH in infested sites. However, they did not detect significant effects on soil microbiota.

Genetic Integrity

Medusahead has not been shown to impact the genetic integrity of native species. Although some classifications place medusahead in the genus *Elymus*, alongside a number of North American native grasses, there is no evidence that they hybridize.

Chapter 3: Biology and Ecology

Medusahead is a winter annual, native to the Mediterranean region of Europe, an area with a climate of wet winters and warm, dry summers. Thus, medusahead is well suited to the Mediterranean-type climate common in semiarid parts of the western United States. Such regions are characterized by annual grasslands, oak woodlands, and chaparral communities. In addition to Mediterranean climatic regions, medusahead also thrives in drier parts of the Intermountain West and the Great Basin, which are dominated by shrubs, perennial grasses, and downy brome.

Like most winter annual grasses, medusahead germinates in fall, grows slowly during winter, and grows rapidly in spring. However, in areas with a Mediterranean climate pattern, most other winter annual grasses complete their life cycle by mid-spring. Medusahead matures two to four weeks later, after other annual grasses have senesced (Harris 1977; Young 1992). During this late-season maturation period, medusahead can access soil moisture and sunlight without competition from other annual grasses.

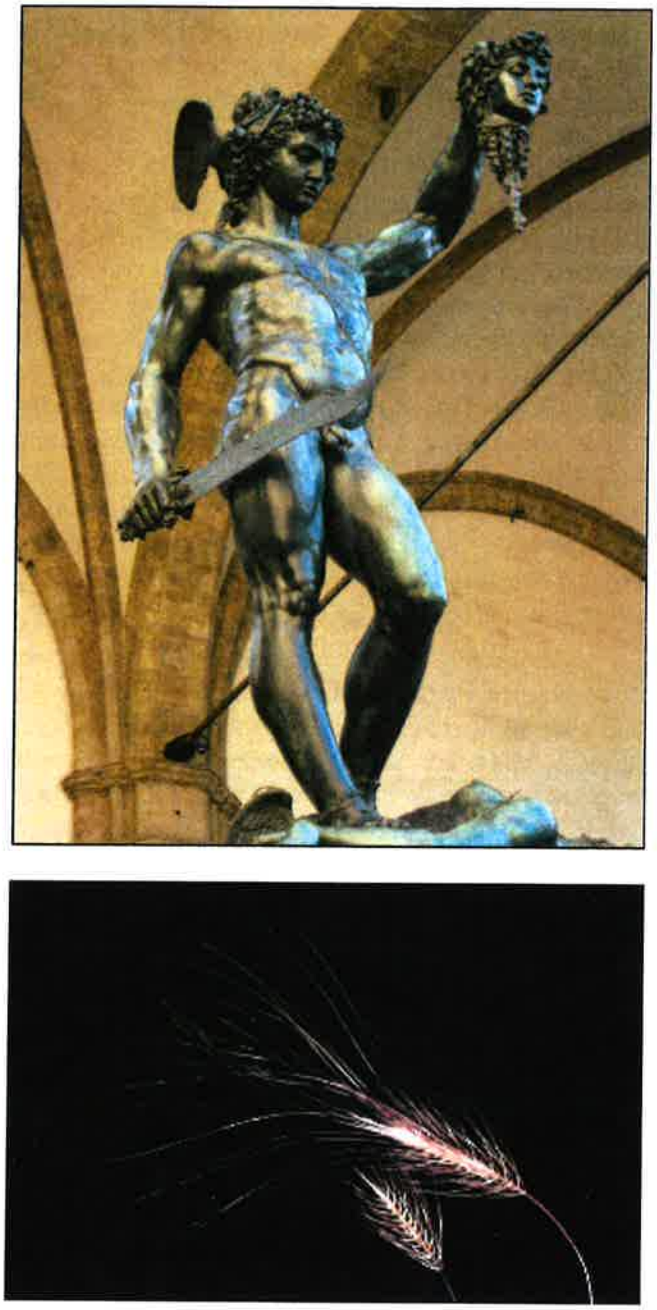

Figure 9. The legend and the reality
In Greek mythology, Perseus defeated the snake-haired Medusa. Medusahead is named for its twisting awns.

Taxonomy and Identification

Medusahead's species name is most commonly given as *Taeniatherum caput-medusae* (L.) Nevski. It is a member of the tribe Triticeae in the Poaceae (grass family). Its taxonomy is complex across its native range (Peters 2013). As a result, its classification has also been difficult in its introduced range, primarily due to multiple, morphologically similar subspecies.

Carl Linnaeus, the father of modern taxonomy, originally classified medusahead in the genus *Elymus* (*Elymus caput-medusae* L.) in 1753, naming the species for the snake-haired Gorgon of Greek mythology (Figure 9). In 1772 Schreber described a second related species, which he called *Elymus crinitus* Schreb., and in 1827 Link described a third species of medusahead, which he named *Elymus platatherus* Link. (Frederiksen 1986). In 1934, Nevski (1934) proposed that the distinct genus *Taeniatherum* be used to classify these three species. He noted that *Taeniatherum* differed from *Elymus* in having one-flowered spikelets with connate, subulate glumes, as well as an annual life cycle. Interestingly, the most recent edition of *The Jepson Manual, Vascular Plants of California*, has lumped a number of related genera into *Elymus* and lists medusahead as *Elymus caput-medusae* L. (Baldwin et al. 2012), although the USDA Plants Database (USDA 2014) and the Biota of North America Program (BONAP 2014) continue to use the genus *Taeniatherum*.

Nevski and others classified three species of *Taeniatherum* in Eurasia, but today most taxonomists consider medusahead to be a single species, *T. caput-medusae* (L.) Nevski, with three subspecies: ssp. *caput-medusae*, ssp. *asperum* (Simk.) Melderis, and ssp. *crinitum* (Schreb.) Melderis (Frederiksen 1986). Of these subspecies, ssp. *caput-medusae* is found in the western Mediterranean, ssp. *crinitum* occurs from eastern Europe to Central Asia, and ssp. *asperum* is found across the geographic distribution of the species. In 1960, Major (1960) determined that the material introduced to the United States was *Taeniatherum caput-medusae* ssp. *asperum*. In a study of *Taeniatherum* using molecular genetic markers, Peters (2013) found that (1) ssp. *crinitum* is genetically differentiated from the other two, (2) some populations of ssp. *caput-medusae* and ssp. *asperum* co-occur within different clusters, and (3) ssp. *asperum* is the most variable. She confirmed that only ssp. *asperum* is believed to occur in the United States, where it is invasive in portions of California, Idaho, Nevada, Oregon, Utah, and Washington. For now, *Taeniatherum caput-medusae* is the most frequently used nomenclature for medusahead.

Major (1960) suggested that the limited variability within populations of medusahead indicated that there were very few introductions of the species, perhaps even a single introduction. More recently, however, genetic analysis has suggested that medusahead was introduced to the United States on at least seven separate occasions (Novak 2004; Novak and Sforza 2008). Similarly, Peters (2013) also showed that there were multiple introductions of medusahead to the western United States, likely from France, Sardinia, Greece, and Turkey. However, Great Basin populations of medusahead are less diverse, probably representing only a couple of introductions (Rector et al. 2013), presumably of arid-adapted biotypes.

Water Use Patterns and Soils

Medusahead can occur on sites with rainfall ranging from 10 to 40 inches (25 to 102 cm) per year, although it is more typically found on sites receiving 12 to 24 inches (30 to 61 cm) (George 1992; Major et al. 1960; Sharp et al. 1957; Torell et al. 1961). Because it matures late compared to other annual grasses, medusahead benefits more from spring rainfall than from earlier fall and winter rainfall (George 1992). This may help to explain why medusahead thrives in arid, high-elevation Great Basin sites: although precipitation is limited, much of it falls as snow which melts during the spring growing season, providing the moisture necessary for medusahead to survive into the early summer. It has also been shown that medusahead is better able to survive on infrequent precipitation events than are downy brome or ventenata (*Ventenata dubia*), two other invasive annual grasses found in the Great Basin (Bansal et al. 2014).

Medusahead is found on many soil types. At the upper end of its precipitation range, it can survive on sites with coarse, poorly developed soils. In general, though, it is less likely to occur on sandy, well-drained substrates (Dahl and Tisdale 1975). Under the right conditions, medusahead can invade areas of loamy soil (Miller 1996). In more arid areas, medusahead tends to require well-developed clay soils, which help retain soil moisture until later in the season (Dahl and Tisdale 1975; Young and Evans 1970) (Figure 10). The thick silica-rich thatch which often develops in infested areas favors medusahead in dry sites, perhaps by acting as a mulch that slows water loss from the soil (Cherr 2009). Soil disturbance increases the potential for medusahead invasion on all soil types (Miller 1996).

Soils with high nutrient levels are more susceptible to medusahead invasion and establishment. On such soils, medusahead also is more likely to inhibit native vegetation, because its seedlings acquire soil resources more efficiently than do native grass seedlings. Although medusahead can potentially outperform native species on either low or high nutrient soils, the difference in growth rates is exacerbated under high nutrient conditions (James 2008a, 2008b; Mangla et al. 2011; Monaco et al. 2003b; Young and Mangold 2008).

Figure 10. Shrink-swell clays favor medusahead
In drier areas, soils which retain water help this species to survive (Photo: Alex Boehm, USDA-ARS, Boise, ID)

In a reciprocal transplant experiment, Blank and Sforza (2007) found that medusahead seeds from both California and France produced larger plants in California soil compared to French soil, reflecting higher nutrient levels in the soils here. California plants also appeared to have evolved a greater ability to take up manganese from the soil.

It has been reported that soil biotic crusts are absent in parts of the Great Basin infested with medusahead (Kaltenecker 1997; Young 1992). Biotic crusts are microfloral communities of algae, bacteria, fungi, and lichens which grow on the soil surface in semiarid regions (Figure 11). These crusts stabilize soils, influence nutrient levels, and help to retain moisture (Belnap 1994; St. Clair and Johansen 1993). Biotic crusts can be broken up and damaged by trampling, as in areas of heavy grazing, and may take many years to recover (Cole 1990). Invasive annuals such as medusahead find it easier to establish on loose soil in the absence of biotic crusts (Kaltenecker 1997).

Figure 11. Biotic (cryptogamic) crust
Natural Bridges National Monument, UT. These crusts are found on arid-region soils worldwide. (Photo: Nihonjoe, Wikimedia Commons) →

It is hard to say whether preexisting damage to biotic crusts in the Great Basin facilitated medusahead invasion, or the biotic crusts began to fail as a result of invasion. However, it is also known that fire can injure biotic crusts, and thus increases in fire frequency with medusahead invasion are likely to have a negative impact.

Germination, Dormancy, and Seed Longevity

Like most other winter annual grasses, medusahead begins to germinate in fall with the first rains, and rapidly develops its root system during winter (Johnson et al. 2011; Sheley et al. 1993). However, seeds can continue to germinate through winter and spring in milder climates (Young 1992). In colder areas with winter snowfall, there can be a second large flush of germination in spring after the snow melts.

Most seeds have a minimal dormancy period and germinate in the first season after dropping from the parent plant (Hironaka 1961; Murphy and Turner 1959; Sharp et al. 1957; Young et al. 1968). When dormancy does occur it appears to be a temperature-related afterripening process, where germination will not occur except after exposure to cold temperatures for 90 to 120 days after maturity (Young et al. 1968). It has been suggested that this afterripening period is controlled by inhibitory substances in the awns of fresh seed (Nelson and Wilson 1969).

In laboratory studies optimal germination of medusahead occurs at 68 to 77 F (20 to 25 C). However, when seeds are in litter in the field, optimum germination temperatures appear to be lower (50 to 59 F; 10 to 15 C), comparable to typical fall temperatures following rainfall events (Young et al. 1971).

Heavy infestations of medusahead can produce dense stands of seedlings with 130 to 1,860 plants ft^{-2} (1,400 to 20,000 plants m^{-2}), depending on the site (Bartolome 1979; Johnson et al. 2011; Sharp et al. 1957). Because the germination rate is so high and seed dormancy is low, it appears that the majority of medusahead seeds persist in the soil for less than two years, with very few seeds surviving for three years or more (Young et al. 1970).

Effects of Medusahead Thatch

Figure 12. Medusahead can germinate in and under thatch
(Photo: Ryan Steineckert, Eastern Oregon Agricultural Research Center, Burns, OR)

Medusahead thatch acts as a barrier preventing the germination or establishment of desirable grasses and forbs (Harris 1977; Young et al. 1971). In contrast to many other species, medusahead establishes well in the presence of its own thatch (Harris 1977; Young et al. 1971). In one study, medusahead seedling establishment was 47 times greater under litter than on bare ground (Evans and Young 1970). The architecture of the caryopsis (seed) is ideal for moving through the litter layer. The caryopsis is narrow and pointed (<1 mm wide) with a very sharp callus tip and an elongated, non-geniculated (bent) awn. The small barbed silica hairs on the caryopsis point backward, allowing the narrow seed to move unidirectionally down through the litter (Young 1992).

Few desirable species have seeds adapted for germination in a thick thatch layer. Many species are forced to germinate in or on top of the litter rather than in contact with the soil (Young et al. 1971). We speculate that small-seeded species which do reach the soil surface have trouble generating shoots long enough to reach above the litter. Thus, the establishment of desirable rangeland species is restricted when a thick medusahead litter layer is present (Davies and Svejcar 2008; Evans and Young 1970; Harris 1977; Young et al. 1971; Young and Mangold 2008).

Unlike most other rangeland species, medusahead seeds are adapted to germinate in and under thatch (Figure 12). Germination is controlled by the relative humidity within the litter. Each seed sends out an aerial root which is more resistant to drying than initial roots of competing species (Young et al. 1971). In addition, should the primary root dry and die, the seed can produce multiple new adventitious roots following remoistening (Young 1992). This affords medusahead a big advantage, as a caryopsis has multiple opportunities to root even under drying events that kill most competing seedlings.

Growth and Establishment

Following germination in fall or winter, medusahead grows slowly during the cool months. In the cooler parts of its range, leaf development in fall-germinating plants can reach a few inches before cold weather slows the process (Young 1992). However, growth can continue, even under a layer of snow (Harris and Wilson 1970; Hironaka 1961). In fact, in cold temperatures medusahead roots grow faster than do the roots of perennial grasses (Harris and Goebel 1976). This investment allows medusahead to make a rapid start in spring.

When the weather warms in spring, medusahead begins a period of rapid aboveground growth. The youngest leaves are very narrow, bright green, in a flattened clump. As growth continues the plants develop longer leaves and often take on a grey-green hue. Eventually the plants develop tillers, which may be more-or-less prostrate in open areas but erect in dense grassland. Two to three months after spring growth begins, the plants develop flowering stems (culms) and heads. Initiation of flowering often occurs in mid- to late April in milder climates at lower elevations, and from late May to early June in cooler climates at higher elevations (Kyser et al. 2012a; Lusk et al. 1961; Sweet et al. 2008). Medusahead appears to require hot summer temperatures – and may have a day-length trigger – for reaching maturity (George 1992).

At maturity, medusahead populations can exceed 930 plants ft^{-2} (10,000 plants m^{-2}) (Young 1992). (Figure 13 shows an example of the kind of spacing this plant density represents.) However, individual plants are phenotypically plastic enough that a population of 1 plant ft^{-2} (10 plants m^{-2}) has the potential to produce more seed than plants at a thousand times greater density (Young 1992). In areas where control efforts reduce the density of medusahead the following season, surviving individual plants grow larger and may reach similar values for total cover and seedhead production (Kyser et al. 2013). In addition, low-density populations of medusahead may remain green and productive longer into the growing season because there are more resources available to individual plants, particularly soil moisture.

Reproduction and Seed Dispersal

Studies of both native and invasive populations of medusahead have determined that this species is almost entirely self-pollinated (Prior et al. 2013). Flowering generally occurs from late spring to early summer (Sweet et al. 2008), with most seedheads maturing by July (Sharp et al. 1957). In contrast, most other annual grasses have completed their life cycle and their seeds have senesced before medusahead seeds have matured. For example, downy brome in the Great Basin flowers two to four weeks earlier than medusahead (Dahl and Tisdale 1975; McKell et al. 1962a; Young et al. 1970). Similarly, at lower elevations, annual forage grasses such as slender oat and wild oat (*Avena barbata* and *A. fatua*), soft chess (*Bromus hordeaceus*), and rye grass (*Lolium perenne* ssp. *multiflorum*, also called Italian ryegrass) flower two to four weeks earlier than medusahead. For this reason, medusahead is often referred to as a 'late-season grass' (Figure 14).

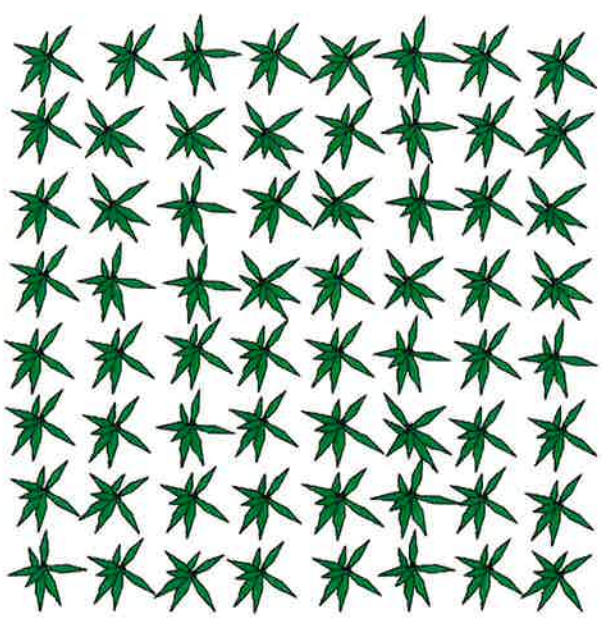

Figure 13. Density of 10,000 plants m^{-2}
Actual size portrayal.

Figure 14. Medusahead is still green
when most other annuals have senesced.

Figure 15. Medusahead seedheads
Seedheads ripen from green to reddish, then finally to straw-colored.

Figure 16. Seeds from a single head
Medusahead seeds twist as they dry out. This may help them catch onto animal fur.

The flowering heads of medusahead are green when they first appear, taking on a reddish tinge as they mature, and finally drying to a straw color at senescence and seed dispersal (Figure 15). Seedheads take about one month to go from green to senescent (Sweet et al. 2008). Once the seeds are filled, it appears that most seeds are viable even in the green stage (Sweet et al. 2008).

An average medusahead plant produces three to five seedheads, with a mean of 5.6 seeds per head in drier areas and 8.7 seeds per head in wetter sites (Sharp et al. 1957) (Figure 16). In richer soils, or in areas where competition is limited, medusahead may produce many more heads and more seeds per head (Miller et al. 1999) (Figure 17). Like most annual species, medusahead produces high numbers of seeds per unit area per year, with measurements ranging

Figure 17. A single green medusahead plant

Under the right conditions, a single plant can produce dozens of seedheads and hundreds of seeds. (Photo: Ryan Steineckert, Eastern Oregon Agricultural Research Center, Burns, OR)

from 130 to 5,574 seeds ft^{-1} (1,400 to 60,000 seeds m^{-2}) (Clausnitzer et al. 1999; Major et al. 1960; Young 1992). This equates to 5.7 to 243 million seed ac^{-1} (14 to 600 million seed ha^{-1}).

Medusahead maturation and seed disarticulation generally continue through most of summer (DiTomaso et al. 2008; Laca 2009). A few seeds will continue to disperse from the parent plants into fall (Davies 2008). At maturity, the seedheads disarticulate easily, and seed usually drops close to the parent plant. Studies have shown that 75% of seeds land less than 1.6 ft (0.5 m) from the invasion front, and most of the remaining seeds disperse no further than 6.6 ft (2 m) (Davies 2008).

Although most seed remains in, or near, the infestation, long-distance movement of seeds can occur through a variety of vectors, including animals, human activity, wind, and water (Nafus and Davies 2014).

Medusahead seeds have long awns covered in small barbs that facilitate dispersal by adhesion to the fur of animals, especially sheep (Davies 2008; Davies and Sheley 2007a; Furbush 1953; Miller 1996). Medusahead seeds also can be transported through human activity. Seed caught in clothing, equipment, the fur of pets, or mud adhering to a vehicle can move long distances and infest new areas (Davies 2008; Davies et al. 2013; Nafus and Davies 2014)

Figure 18. Medusahead in a riparian zone

In this scenario, a river running through high desert steppe has the potential to move medusahead seed. Note that downy brome is ready to drop seed although medusahead is still green. (Photo: Ryan Steineckert, Eastern Oregon Agricultural Research Center, Burns, OR)

Wind has also been shown to be a vector for the short-distance movement of medusahead seed, though usually indirectly (Davies and Sheley 2007b; Furbush 1953). For example, medusahead seed can be moved short distances [typically less than 3.9 inches (10 cm)] when the disarticulated seeds get caught on other plants whose main mode of dispersal is wind, including tumble mustard (*Sisymbrium* *altissimum*) and Russian-thistle (*Salsola tragus*) (Davies and Sheley 2007b). In some cases whole medusahead inflorescences may break off and tumble with the wind (Turner et al. 1963).

Local dispersal can also occur through water when medusahead is growing near riparian areas, though this is unusual (Figure 18).

Medusahead probably is not widely distributed by granivores (grain feeders). Most mammalian granivores don't appear to stash the seed, with the exception of deer mice (*Peromyscus maniculatus*) (Longland 1994). The seeds are not liked by birds (Goebel and Berry 1976) and in fact appear to be more-or-less indigestible (Savage et al. 1969).

Following seed drop, the empty seedheads with long bracts still attached may remain standing on the dead stalks through fall and into winter (Figure 19), eventually turning ash-grey in color. These medusahead skeletons can help the land manager to determine where to focus control efforts even in the off-season (Figure 20).

Figure 19. Mature seedheads
before and after dropping seed

Figure 20. Medusahead skeletons
often remain standing after seed drop.

Chapter 4: Management

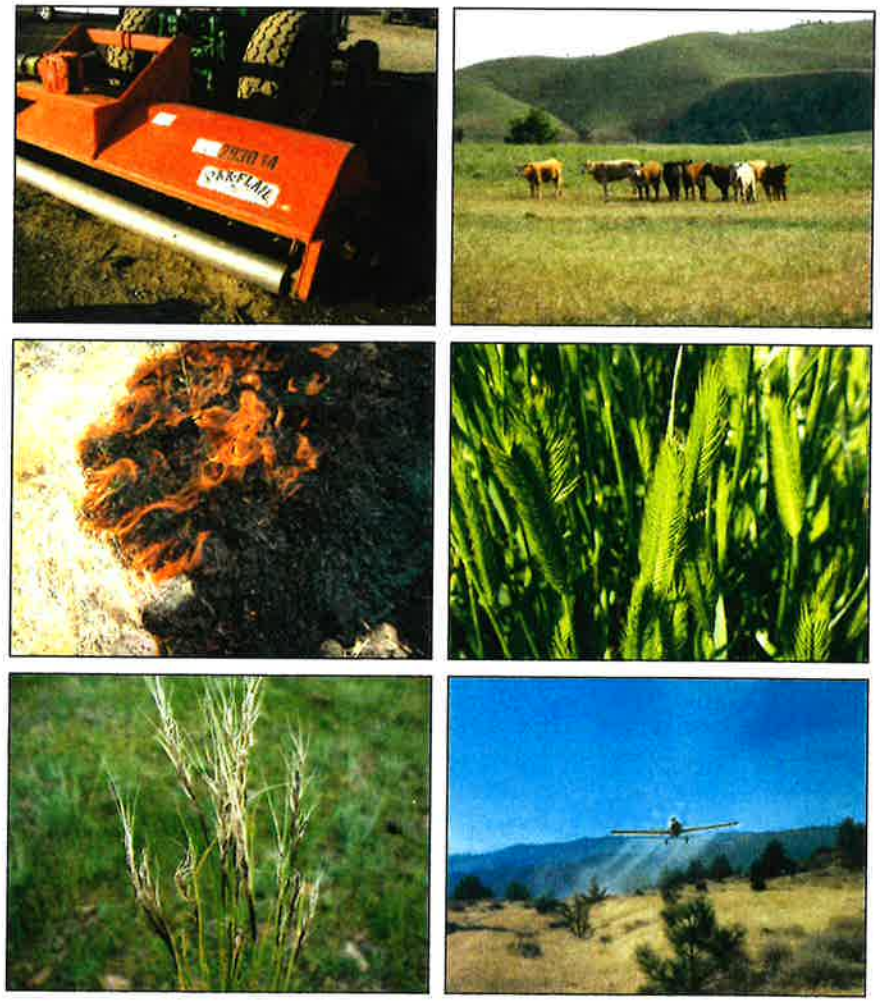

Figure 21. Management techniques
Mechanical treatments, grazing management, prescribed burning, revegetation, biocontrol, and chemical treatments are discussed below. (Mower, G. Kyser; cattle, J. Davy; burn, K. Davies; wheatgrass, M. Lavin; smut fungus, R. Sforza; aerial application, R. Wilson. For full credits see following sections.)

It can be difficult to selectively remove an invasive grass such as medusahead from a grassland community. Many treatments that might be effective in controlling medusahead are likely to have negative effects on other plant species that are desirable components of forage and habitat. For example, some herbicides that control medusahead can also severely impact other desirable vegetation, particularly other annual grasses (Kyser et al. 2007; Shinn and Thill 2004).

A number of different management options are available, broadly grouped as mechanical, cultural, and chemical control methods (Figure 21). Regardless of the management technique used, medusahead must be prevented from producing new seed for two to three years in order to deplete the soil seedbank. In some cases, combining multiple management techniques will allow prevention of two years' seed production with a single year of activity: for example, prescribed burning in summer (prevents seed production in the first year) followed by application of preemergence herbicide in fall (prevents seed production in the following year). Two years of control may reduce the population to the point where less intensive management methods can be used, e.g., lower rates of herbicide or localized use of mechanical treatments or high-density grazing.

The scientific literature reports many inconsistencies in the control of medusahead. Some control techniques which appear to work well in one area may not provide sufficient control in another area. This reflects the wide scope of environments that medusahead occupies, over a diverse range of climates, soil types, and plant communities. When considering control techniques, the most important distinction to make is between low-elevation sites (e.g., the foothills, grasslands, and coastal ranges of California, Oregon, and Washington) and high-elevation sites (cold-winter steppe communities in the Great Basin). Medusahead management on low-elevation foothill rangeland is very different than management on high-elevation rangeland in the intermountain region.

Management on Low-Elevation Rangeland

Low-elevation rangeland, in the foothills, coastal ranges, and large valleys, consists primarily of annual grassland. Under proper grazing management, the annual grasses here are very competitive with medusahead. However, medusahead thatch is a much greater problem on these highly productive sites.

One of the ways medusahead successfully competes with other rangeland plants, particularly at low elevations, is its late flowering time. Medusahead flowers and goes to seed in late spring, when soil moisture reserves are nearly depleted and after most other plants have senesced. This allows medusahead to use the remaining soil moisture without competition from other species. However, this also leaves a window of two to four weeks during which medusahead can be controlled with minimal damage to desirable forage species. If medusahead foliage and seedheads are removed or killed in late spring before seeds mature – by mechanical means, fire, grazing, or chemicals – the plants usually do not have the resources to recover and produce new seedheads. As an additional benefit, desirable plants have usually dropped their seed by this time and are thus less vulnerable to control methods used for medusahead.

A second way that medusahead competes with other plants, especially on low-elevation, high productivity sites, is by building up a persistent thatch which suppresses germination and establishment of desirable species. Control techniques that remove the thatch, e.g., some mechanical treatments, fire, and intensive grazing, can help to reduce medusahead's competitiveness compared to other species, resulting in some suppression of the weed (Evans and Young 1970; Kyser et al. 2007).

Management on Intermountain Rangeland

Options for managing medusahead on high-elevation rangeland are somewhat limited compared to low-elevation sites. Because winter is longer and the growing season is shorter, most plant species flower at about the same time, as soon as the weather warms in spring. Unlike low-elevation infestations, there isn't much of a control window between the flowering times for desirable species and medusahead. Prescribed burning and some mechanical control techniques are less effective at high elevations and may cause more injury to native species than to medusahead.

On the other hand, some fall-applied preemergence herbicides appear to be more effective on high-elevation sites. This may be because these chemicals degrade more slowly during the colder winters. Fall-applied preemergence herbicides are also more widely used in the intermountain region because most desirable vegetation is perennial, thus allowing the use of preemergence chemicals for selective control of exotic annuals such as medusahead.

Economics of Medusahead Control

Private land grazing fees during 2005-2010 averaged \$16 to \$18 per animal unit month (AUM) in California and \$14 to \$15 per AUM in other western states (Stechman 2011). An animal unit is commonly referenced as a lactating cow weighing 1,200 lb (544 kg) with a small calf weighing less than 300 lb (136 kg). At peak milk production of 20 lb (9 kg) day^{-1}, two to three months after calving, the NRC estimates dry matter consumption of approximately 28 lb (13 kg) day^{-1} (National Research Council 2000). Thus an AUM is approximately 840 lb (381 kg) of forage.

One site in the Sierra Nevada foothills provides an example of forage production capability in the annual rangeland type (George et al. 2001). Over 16 years, this site produced an average 2,800 lb acre^{-1} (3,138 kg ha^{-1}) of dry matter during each six-month growing season. (This is considered a very productive site, comparable to many parts of the northern Central Valley and the California coastal prairie.) On topography with 0 to 10% slopes, as at this site, cattle are able to harvest about 50% of forage production. Thus, this foothill site provided average forage of 1,400 lb acre^{-1} (1,570 kg ha^{-1}), or 1.7 AUM acre^{-1} (4.2 AUM ha^{-1}).

Table 1. Typical forage production in regions of the western states

Estimated production values are from the National Resources Conservation Service Web Soil Survey. Rental values are from American Society of Farm Managers and Rural Appraisers (2013).

Region	Est. grazeable forage (50% of production on 0 to 10% slopes)	Est. AUM (animal unit months)	Est. forage value at \$16 AUM^{-1}	2013 rental values (per acre)
Northern valleys, foothills, & coast range (CA)	1,000 to 2,000 lb acre^{-1} (1,120 to 2,240 kg ha^{-1})	1.2 to 2.4 acre^{-1} (2.9 to 5.9 ha^{-1})	\$19 to \$38 acre^{-1} (\$47 to \$94 ha^{-1})	\$10 to \$30
Southern Central Valley & coast range (CA)	500 to 1,250 lb acre^{-1} (560 to 1,400 kg ha^{-1})	0.6 to 1.5 acre^{-1} (1.5 to 3.7 ha^{-1})	\$10 to \$24 acre^{-1} (\$24 to \$59 ha^{-1})	\$6 to \$20 (west side) \$12 to \$35 (east side)
Intermountain region	200 to 900 lb acre^{-1} (224 to 1,008 kg ha^{-1})	0.2 to 1.1 acre^{-1} (0.6 to 2.6 ha^{-1})	\$4 to \$17 acre^{-1} (\$9 to \$42 ha^{-1})	\$12 to \$18 (northern NV)

Table 1 presents typical forage production for several regions in the western states. It should be noted that foraging efficiency decreases drastically with increasing slopes (Becchetti et al. 2011). There are also requirements for a minimum amount of residual dry matter (RDM) to be left on site following grazing, to provide for erosion control, rainfall infiltration, and ecosystem recovery; these requirements vary by site (Bechetti et al. 2011).

At \$16 to \$18 per AUM, rangeland with grazeable production of 1.7 AUM acre^{-1} (4.2 AUM ha^{-1}) has a theoretical lease value of \$27 to \$31 acre^{-1} (\$67 to \$77 ha^{-1}). This value assumes that all forage produced is grazed by livestock. However, dense infestations of medusahead can reduce carrying capacities by up to 70% (Major et al. 1960; Hironaka 1961; George 1992). A 70% reduction would reduce the theoretical harvest to 0.5 AUM acre^{-1} (1.3 AUM ha^{-1}), decreasing the value to \$8 to \$9 acre^{-1} (\$20 to \$23 ha^{-1}).

In this example of a heavy infestation of medusahead on a highly productive site, a single year of medusahead control would justify an investment of \$19 to \$22 acre^{-1} (\$47 to \$54 ha^{-1}). A more moderate infestation that reduces carrying capacity by 40% would justify an investment of \$11 to \$13 acre^{-1} (\$27 to \$32 ha^{-1}).

This example makes many assumptions that may prove unrealistic. For example, it assumes that medusahead is completely controlled, that forage will return to full carrying capacity in the year of treatment, and that all forage that replaces medusahead is good for grazing. In reality, many treatments for controlling medusahead will result in temporary reductions in forage, and medusahead management is usually a multi-year project. Thus, even in this "best case" example, it will take several years to realize a return on the investment in controlling medusahead.

Investments in medusahead control will realize the fastest return on highly productive rangelands with mild topography that is highly accessible to grazing. However, at any site, the benefits of controlling medusahead will accumulate over many years. In addition, controlling medusahead at one site reduces the risk of the infestation spreading to surrounding areas.

Chapter 5: Mechanical Control Methods

"Mechanical control" of medusahead refers to any technique used to remove or physically damage the plants. Mechanical control on a large scale requires the use of power equipment.

Hand Pulling or Hoeing

Pulling or hoeing individual medusahead plants may be effective on a small scale. This should be done when medusahead plants are large enough to distinguish from other grasses, but before medusahead sets seed. Most medusahead infestations are too dense and on too broad a scale for this to be a practical option. However, removal of individual plants may be useful in newly established, small populations or as maintenance on sites following large-scale control efforts. One advantage to this technique, where practical, is that it is very selective and causes minimal disturbance to desirable species.

Mowing

Mowing in late spring when medusahead is in the early flowering stage can suppress seed production and reduce the medusahead population in the following year. For effective control, mowing must be completed late in the plant's development but before medusahead produces viable seed. On low-elevation rangeland, desirable forage grasses are usually finished producing seed by late spring, so mowing won't impede their reproduction.

Mowing too early, when medusahead is still small, will miss low-growing plants. In addition, an early mowing is likely to cut off desirable plant species before they can set seed. Mowing in mid-spring, when medusahead is larger but has not yet begun to send up flowering stems, may remove some medusahead foliage but still gives medusahead enough time to recover and go to flowering. For example, one study found that April mowing did not control medusahead, but May mowing was effective (Turner 1968). In clipping studies, it has been found that clipping at 1.2 to 2.4 inches (3 to 6 cm) during early flowering (from emergence of awns to emergence of anthers) nearly eliminated seed production (Zhang et al. 2010a).

One drawback to mowing is that it limits the availability of late-season forage. Although mowing doesn't remove forageable material from the site, it does break up the material and lay it on the ground where it may be of less interest to grazers. Mowing may also limit seed production in late-flowering desirable grasses such as rye grass. It may not be possible to mow in steep or rocky terrain. When rocks are present, mower blades may strike sparks and can start fires. And even in the best circumstances, mowers travel slowly, so there are practical limits to the total area which can be managed in this way.

Mowing is less advisable for medusahead infestations in high-elevation sagebrush communities. Studies have shown that mowing in these sites tends to favor exotic annual species, such as medusahead, over native perennials such as sagebrush and bunchgrasses (Davies et al. 2011, 2012). In addition, fuel costs and rocky, rugged terrain often make mowing such areas impractical.

Rangeland is usually mowed at a height of roughly 4 inches (10 cm). Mowers used in rangeland include flail and rotary (deck) mowers. Both types are pulled by tractors and powered by the tractors' power takeoff. Rotary mowers have fixed blades on a vertical shaft, like a large lawnmower. Flails have a

Figure 22. Flail mower
(Photo: Guy Kyser)

row of swinging metal rods or chains on a horizontal shaft (Figure 22). Flails are more widely used in rangeland, because the rods or chains are less likely to be damaged if they hit rocks. If the terrain is even and relatively free of rocks, a flail mower also gives the option of lowering the mow height to almost ground level, where it can break up the medusahead thatch. Thatch removal can give desirable forage species a competitive advantage, helping to suppress medusahead in the next season.

Tillage

Deep tillage (i.e., disking) is not a realistic option in many medusahead-infested areas owing to slopes, rocky soils, and the presence of desirable shrubs and trees (Figure 23). Tillage also increases the potential for erosion, loss of soil moisture, loss of organic matter, and loss of microbiotic crusts (Kaltenecker 1997; Young 1992). However, where possible, tillage can control existing medusahead plants, bury seed, and break up thatch. Compared to other grass species, medusahead seeds emerge poorly from depths greater than 2 inches (5 cm) (Young et al. 1969a), so tillage can favor desirable species. Thatch removal by tillage decreases medusahead's competitiveness and exposes the soil for more effective application of preemergence herbicides. Tillage should be done before medusahead produces seed. Tillage is a good way to prepare a site for reseeding (Young et al. 1969b); and in fact, owing to the potential drawbacks to tilling on rangeland, it is highly recommended that reseeding be included as a followup to tillage operations.

Because sagebrush and other native species in sagebrush steppe are not well adapted to disturbance, deep tillage is not recommended for medusahead control in intermountain rangeland. It is expected that this would have negative effects on the plant community, similar to mowing (see above). However, tillage may be a useful option in high-country pasture or other managed areas.

Shallow tillage, or harrowing, can help with medusahead management in some situations. Harrowing can be used to remove medusahead thatch and to incorporate seed during revegetation. However, harrowing does not control existing medusahead plants.

Harrowing causes less soil disturbance than deep tillage and can be used on rockier terrain. Some

Figure 23. Disk (disk harrow)
(Photo: Josh Davy)

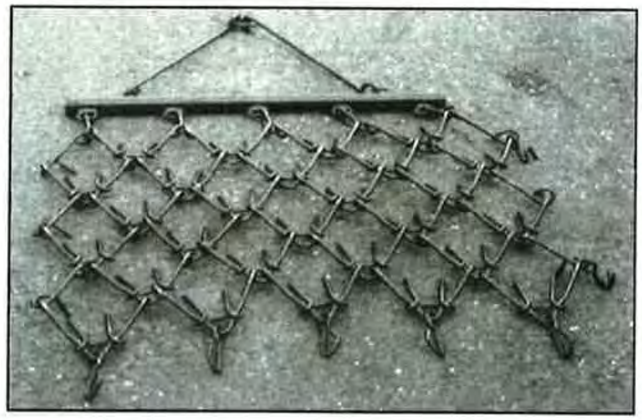

Figure 24. Chain harrow
(Photo: BSG Tractors and Machinery, UK)

types are flexible (e.g., chain harrow, Figure 24) or 'springy' (e.g., spring tine harrow) and will slide over obstacles without breaking. Harrows also tend to weigh less than disks and can be pulled by smaller equipment; some can be pulled by ATVs or horses.

In one study, harrowing in fall with a spike harrow (at a high-elevation site in Lassen County, CA) or raking by hand (at a low-elevation site in Yolo County, CA) reduced medusahead cover by about 50% the following year (Kyser et al. 2007). This was presumably a result of removing the medusahead thatch, giving a greater competitive advantage to other grass species. Thatch removal also improved the efficacy of applications of the preemergence herbicide imazapic, which can be tied up in litter.

Chapter 6: Cultural Control Methods

Grazing Management

Grazing is a natural process in grasslands. Properly managed livestock grazing can help to remove litter, recycle nutrients, stimulate tillering of perennial grasses, and reduce seedbanks of invasive plants (DiTomaso and Smith 2012). Furthermore, proper livestock grazing can restore rangeland services and increase resistance to invasion (Krueger-Mangold et al. 2006). Under light to moderate levels of grazing, many native forbs can increase in cover and frequency (Hayes and Holl 2003). In contrast, grazing exclusion during the growing season in California grasslands can lead to grass dominance and reductions in native and exotic legumes (*Trifolium* spp. and *Medicago* spp.) and filaree (*Erodium* spp.) (Bentley and Talbot 1951; Biswell 1956; Jones and Evans 1960). Another advantage of grazing as a management tool is that it can generate revenue while improving rangelands (DiTomaso and Smith 2012).

Prevention of overgrazing is one of the most important aspects of grazing management. Grazing too heavily in early spring can inhibit or remove competitive forage species, leaving more resources for medusahead as it comes into flower. In the intermountain region, overgrazing of perennial grasses in the intermountain region has assisted the invasion of downy brome (Knapp 1996) and is likely to favor medusahead (Sheley et al. 2008). Continuous grazing on perennial plants weakens the root systems as the plants sacrifice roots to regenerate shoot growth for photosynthesis. As the perennial grasses lose root mass, more water and nutrients become available to medusahead (DiTomaso and Smith 2012).

Although overgrazing can damage desirable plant populations, grazing too lightly can allow animals to select only the most desirable forage, leaving the less palatable species. This is often the case with spiny thistle species. At early stages of development, medusahead is palatable and its protein content is reportedly comparable to many other annual grass species (Bovey et al. 1961; Lusk et al. 1961; Torell et al. 1961). However, as medusahead matures it accumulates silica in the seedheads and foliage and becomes less palatable. At later stages, animals will avoid foraging on medusahead, which can lead to high seed production and larger infestations in subsequent years. Furthermore, once medusahead has flowered, the long sharp awns on the mature reproductive structures pose a risk of damage to flesh and fleece and can injure the eyes, nose, and mouth parts of grazing animals. In severe cases, these grass awns can penetrate the gums and jaw, causing irritation and infection in a condition called lump jaw (Mosley and Roselle 2006).

There are two key principles in using grazing to manage medusahead (DiTomaso and Smith 2012). First, medusahead is an annual grass and must produce seeds to survive. Therefore, it is critical to prevent medusahead plants from reproducing. By reducing the number of seeds produced, seed banks will eventually be depleted. Although grazing is not likely to prevent all seed production, even partial reduction in seed production by grazing can be helpful.

Second, it is important to maintain vigorous and healthy desirable vegetation. In the rangelands and grasslands of California, this may be other annual grasses, but in other regions of the west, it may be primarily perennial grasses. Grazing should be conducted at times and stocking rates which minimize the impact on desired species but maximize the effect on medusahead. Proper grazing can help shift the competitive advantage to favor desired species.

Regardless of management some sites are more susceptible to invasion than others, and even the best stewardship, including grazing management, may not prevent medusahead invasion. For example, on a sagebrush site with deep clay soil in northeastern California the level of medusahead infestation was similar regardless of whether the area was grazed or protected from grazing for over 30 years (Wagner et al. 2001). However, in many other areas grazing management can be an effective tool to reduce medusahead cover and seed production, as well as increase the cover of native forb species (DiTomaso et al. 2008; Griggs 2000; Reiner and Craig 2011).

Timing and Intensity of Grazing

Using grazing treatments at the correct timing and intensity is important in all areas of the western

United States (DiTomaso et al. 2008; Sheley et al. 2008; Sheley and Svejcar 2009). When medusahead is grazed at the proper timing, livestock can dramatically reduce seed production by foraging on the top portion of the plant. Such grazing, often referred to as precision grazing, can eventually reduce the medusahead seedbank (DiTomaso and Smith 2012). Studies have shown that the optimal timing is in late spring after medusahead stems begin to elongate and before the seed milk stage (DiTomaso et al. 2008; Emilio Laca, pers. comm.).

The proper intensity of grazing treatments is also critical to successful control of medusahead. The most effective results occur when grazing is high intensity and short duration (DiTomaso and Smith 2012). However, precision grazing of medusahead might be limited if high stocking densities have a negative impact on individual animal performance.

Figure 25. Intensive grazing with sheep
Late May grazing (at early flowering) controlled most medusahead in this plot.

Effect of Sheep and Cattle Grazing on Medusahead

Although medusahead palatability to livestock is relatively low, sheep will graze medusahead in the vegetative stage. As plants mature, sheep begin to selectively avoid medusahead, and it has been noted that sheep avoid areas with heavy medusahead thatch (Lusk et al. 1961). However, at high stocking rates sheep uniformly graze medusahead-infested grasslands in all vegetative stages.

In early studies using sheep, it was shown that heavy grazing in late spring reduced medusahead stands in summer (Lusk et al. 1961; Turner 1968). By contrast, grazing in early spring (March) or fall (October to November), alone or in combination, did not reduce medusahead cover (DiTomaso et al. 2008), and year-round grazing was associated with greater medusahead frequency (Harrison et al. 2003).

High density, short duration, mid-spring grazing in late April to early May gave excellent control of medusahead on California grassland in the Central Valley (DiTomaso et al. 2008) (Figure 25). At this timing, plants were in the "boot" stage or stem elongation phase, which is just prior to exposure of the inflorescences. At a high stocking rate (Table 2), sheep feed less selectively. The high density increased the grazing pressure on medusahead while avoiding detrimental impacts on more desirable species, which can occur with selective feeding behavior. As a benefit, this high intensity grazing did not cause detectable persistent effects on the productivity of the grassland (DiTomaso et al. 2008).

Summer evaluations of the April/May grazing studies showed a reduction in medusahead cover of 86% to 100% relative to ungrazed plots, regardless of whether it was used in combination with early spring or fall grazing (DiTomaso et al. 2008) (Figure

Table 2. Intensive grazing on one acre
Equivalents for rates used in DiTomaso et al. 2008

Number of sheep	Number of cattle	Time (days)	Stocking rate (AUD/acre)
400	80	1	80
100	20	4	80
57	11.4	7	80
40	8	10	80
28.5	5.7	14	80

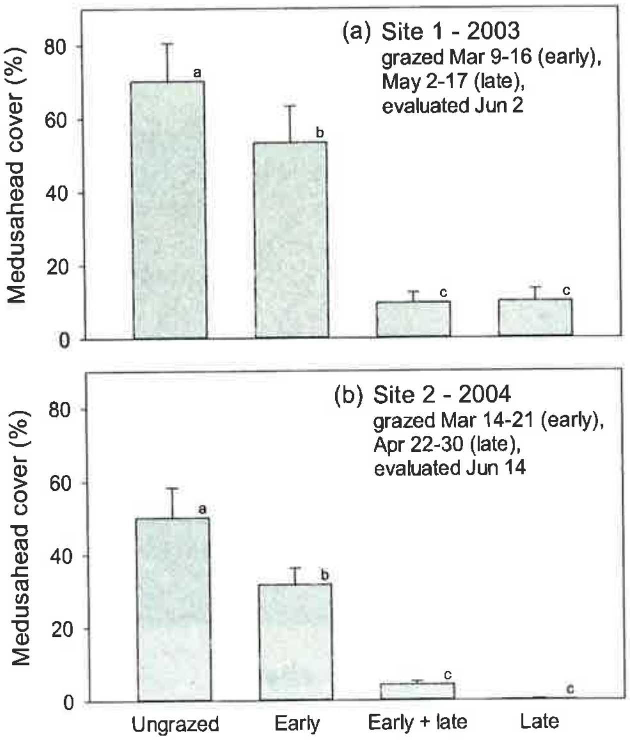

Figure 26. Timing of grazing

In intensive grazing trials with sheep in Yolo County, grazing too early (in March, around the time of tillering) was much less effective than grazing in May, at early heading (DiTomaso et al. 2008).

Figure 27. Prescribed grazing with yearling cattle
Central Valley foothills near Willows, CA. (Photo: Josh Davy)

26). Furthermore, mid-spring grazing just before flowering increased broadleaf cover, native species richness and abundance, and plant diversity.

Despite the success demonstrated with sheep grazing in managing medusahead, there are some logistical obstacles to precision grazing. Because the timing window is fairly narrow and the animal stocking rates are high, sheep grazing is unlikely to be a practical solution for management of large medusahead infestations (DiTomaso et al. 2008). In California grasslands, the sheep stocking rate that gave the most effective control of medusahead was equivalent to at least 1.6 animal units (AU) ac^{-1} (4 AU ha^{-1}) over 2 weeks (Cherr 2009). If a rancher owns a 247-acre (100-hectare) ranch and grazes year-round with a constant stocking rate, the area could support 15 to 30 sheep (0.37 to 0.75 AU ac^{-1}; 0.15 to 0.30 AU ha^{-1}), depending on local forage productivity. These animals could be used to apply precision medusahead grazing at the proper timing on only 5 to 12.4 ac (2 to 5 ha) (DiTomaso et al. 2008).

Because of the limitations of grazing as a management tool, it is most likely that control of medusahead with sheep grazing will be primarily used for small infestations, such as patches. In cases where medusahead control is of high value, custom grazing with hired animals can overcome the limitation of animal availability. It may also be possible to achieve control at lower stocking rates by extending the grazing period.

In a study of the effects of grazing on beef production in Tehama County, California, George et al. (1989) found that 2 years of intensive grazing [2.5 to 3 acres per 500 lb (2.2 to 2.6 ha per 500 kg) calf, for approximately 3 months total during each winter-to-spring growing season] reduced medusahead from 45% of relative vegetative cover to only 10%, and reduced medusahead thatch cover. The timing was the same as that described for sheep grazing. To achieve satisfactory control, however, cattle grazing required a stocking rate greater than one AUM [animal unit month] ac^{-1} (2.5 AUM ha^{-1}) within the 2 to 3 weeks when medusahead was susceptible to defoliation.

In a recent large-scale study over six years in Colusa County, CA, prescribed grazing using cattle was successful in reducing medusahead cover in years when late spring rains did not occur (Davy et al. 2014) (Figure 27). In this study, constraints on available drinking water and a decline in forage quality made it necessary to remove cattle from the grazing area at a relatively consistent timing in late spring each year. In years with late spring rain, sufficient soil moisture was available to allow medusahead to recover from grazing after cattle were removed. However, medusahead cover and seed production were reduced in years with dry spring weather. This suggests that prescribed grazing for medusahead management on a large scale may need to be used as part of a long-term strategy, because weather variations in some years may limit the impact of grazing on medusahead.

In addition to directly foraging on medusahead, intensive grazing by livestock can also trample the thatch layer, which can help to suppress the weed. For example, part of the reduction in medusahead reported by George et al. (1989) is attributed to thatch depletion after two years of heavy grazing during winter and spring. Because thatch reduction allows competing species to increase, heavy grazing often results in increased forb cover and decreased grass cover (McDougald et al. 1991).

On low-elevation annual rangeland, it has also been shown with both cattle (Davy et al., unpublished data) and sheep (Lusk et al. 1961) that range fertilization, especially with nitrogen, improves the palatability and forage attractiveness of medusahead. This reduces grazing selectivity and encourages grazers to concentrate their foraging in fertilized areas. These studies show some promise for the management of medusahead by combining fertilization with grazing, particularly when medusahead occurs in discrete patches.

Prescribed Burning

Medusahead matures a couple of weeks to more than a month later than most other annual species, including grasses (Dahl and Tisdale 1975; Young et al. 1970). In addition, medusahead and other long-awned invasive grasses [e.g., ripgut brome (*Bromus diandrus*), barb goatgrass (*Aegilops triuncialis*)] rely, in part, on animal dispersal for long-distance seed dissemination. Consequently, the seeds remain attached in the inflorescence longer than most desirable grasses. By late spring to early summer, most annual plant species have senesced and dropped their seed. However, the immature seedheads of late-season grasses such as

Figure 28. Prescribed control burn
At the ideal time for burning, medusahead plants are still green but other grasses have senesced.

Figure 29. Testing seed tolerance to heat
Laboratory tests found that medusahead seeds are vulnerable to fire at all stages of ripeness.

medusahead are still ripening in the grassland canopy (Figure 28).

In grasslands, temperatures at the soil surface during a burn typically reach a range of -482 F (-250 C) for a few seconds, not usually hot enough or long enough to kill seeds (DiTomaso et al. 1999; Sweet et al. 2008). Thus, seeds of forage plants on the ground usually escape the effects of fire. However, seeds held in the upper part of the grassland canopy during a burn may experience temperatures of 842 F to 1202 F(450 C to 650 C), hot enough to cause seed mortality (Figure 29). If burning can be applied during the time in late spring when most desirable species have dropped their seeds but medusahead seeds are still on the plants, then medusahead can be selectively controlled by fire. Although burning may not always consume the seedheads, the seeds inside are killed by the high temperatures (Figure 30). Burning also removes thatch, thus eliminating one of medusahead's competitive advantages (Figure 31).

Because burning reduces the medusahead population and removes thatch, even an accidental burn presents an opportunity. Following a burn, other control techniques such as grazing, revegetation, and preemergence herbicides may be more effective. Whether a burn is prescribed or accidental, a land manager should use this opportunity to further manage medusahead.

Figure 30. Seedheads after a burn

During a prescribed burn, all thatch was burned off and these medusahead florets fell to the ground. They appear intact, but all the seeds are dead.

Figure 31. Burning removes medusahead thatch

(Photo: Kirk Davies, Eastern Oregon Agricultural Research Center, Burns, OR)

Site differences in prescribed burn results

Many factors can influence the success of fire, including burn timing, fuel load and moisture, weather conditions, stage of seed maturity, and fire characteristics such as flame temperature and heat exposure time (Harrison et al. 2003; Kyser et al. 2008). While some early studies reported successful control of medusahead using prescribed burning (Furbush 1953; Murphy and Lusk 1961), others reported that burning was unsuccessful (Young et al. 1972) or inconsistent (McKell et al. 1962b). In northeastern California, for example, Young et al. (1972) found that repeated annual burning in mid-summer increased medusahead infestations while decreasing the population of more desirable annual grasses. Similarly, Youtie et al. (1998) conducted summer burns for medusahead control in north-central Oregon. While they showed some initial reduction in medusahead, it and other invasive annual grasses returned to pretreatment levels within two years of the burn.

In contrast to these reports, several studies at lower elevations in California demonstrated good control of medusahead with a single early summer burn (Furbush 1953; McKell et al. 1962b; Pollak and Kan 1998). Although some researchers have speculated that the inconsistent results among these studies might be due to differences in burn time, nearly all burns were conducted at the optimal timing, before seed dispersal but at a time when sufficient fuel load was available to carry a fire.

In a study on medusahead control using prescribed burning, trials were conducted in four regions of California, ranging from Fresno to near the Oregon border in Modoc County (Kyser et al. 2008). On low-elevation, warm-winter rangeland in Central Valley foothills (Fresno and Yolo counties), medusahead control was greater than 95% in the third season following 2 consecutive years of burning, and even a single burn gave significant control. Other annual grasses were slightly reduced and broadleaf species, including legumes, tended to increase. In contrast, in high-elevation, cold-winter Great Basin steppe (Modoc County), 2 years of burning gave no control. This was similar to results from an earlier study (Young et al. 1972) in a nearby location. Successful prescribed burning in warm-winter areas was correlated with the biomass of other annual grasses, besides medusahead, present at the site preceding a burn treatment. Greater production of combustible forage resulted in a slower and more intense burn (Kyser et al. 2008), killing more seed in the exposed inflorescences.

This study indicates that prescribed burning can be an effective control strategy for medusahead in low elevation, warm-winter areas with high annual grass biomass production, but may not be successful in semiarid cool winter areas. In the intermountain region, limited precipitation and a short growing season result in lower annual forage production; in addition, few winter annuals other than medusahead are usually present at such sites. This reduces the fuel load and results in lower intensity fires. Furthermore, in areas where a significant proportion of winter precipitation occurs as snow, the thatch layer from previous years' production tends to be compressed, contributing minimally to the fuel load (Kyser et al. 2008). Burns that occur late in the season, when even perennials are dry enough to carry a fire, are too late to control medusahead seed production. Thus, the effects of burning are less selective, having a greater impact on other species and a reduced impact on medusahead. As a result, high-elevation sagebrush ecosystems are vulnerable to fire, and burning tends to reduce cover of sagebrush and other native species (Young and Evans 1978).

Based on the sites in the burn study described here, we developed a table showing the average number of degree-days above 0 C between October and June, the typical number of annual frost-free days, and the corresponding value for estimated average annual dry-weight production (Table 3). These values give an indication of the type of fuel load which might be expected at each of the four sites. We also include the site for the unsuccessful burn

Table 3. Medusahead control with prescribed burning

Comparison of climatic parameters and medusahead control with prescribed burns in various locations in California (Kyser et al. 2008). Weather and production values are from the National Resources Conservation Service Web Soil Survey. XL Ranch data are from Young et al. (1972).

Study site county	Elevation, ft (m)	Degree-days > 0 C, mean for Oct-Jun	Expected frost-free days	Normal year dry-weight production, lb acre^{-1} (kg ha^{-1})	% control in late spring (summer when available)	
					One year after 1st burn	One year after 2nd burn
Low-elevation sites						
Fresno	558 (170)	3,871	238	1,345 (1,507)	100 (98)	100 (99)
Yolo	295 (90)	4,193	265	1,530 (1,715)	99 (85)	99 (96)
Intermediate site						
Siskiyou	2560 (780)	2,365	125	425 (476)	77 (70)	93
High-elevation sites						
Modoc	5184 (1580)	1,992	90	432 (485)	63	+55
Modoc *(XL Ranch)*	5000 (1520)	1,791	75	556 (623)	+48	+21

+ indicates a percentage increase in medusahead

conducted by Young et al. (1972). These site characteristics are compared with the level of medusahead control after one and two consecutive years of burning at each site. At warm sites (typical winter through spring degree-day totals of roughly 3,000 or more, and more than 200 expected annual frost-free days), two consecutive years of burning achieved satisfactory control of medusahead. At cool sites (<2,000 degree days and 90 or fewer frost-free days), medusahead actually increased following two years of burning. It should be noted that the Siskiyou site was intermediate in its climatic characteristics; control at this site was somewhat less than in the low-elevation sites, and the medusahead population at this site rebounded significantly by two years after the final treatment.

Risks

Despite the potential usefulness of burning, it is often difficult to obtain permits because of air quality and liability issues. These are exacerbated by residential construction in rural areas. When prescribed burning is possible, it can be a successful management tool for a number of late-season invasive annuals in low-elevation sites, including medusahead (Kyser et al. 2008), barb goatgrass (DiTomaso et al. 2001), yellow starthistle (*Centaurea solstitialis*) (DiTomaso et al. 1999, 2006), and ripgut brome (DiTomaso et al. 2006; Kyser and DiTomaso 2002).

The potential impact on air quality is one of the risks associated with prescribed burning. Air quality issues and related requirements, including PM10 emissions, can be a significant problem when burns are conducted adjacent to urban areas (Campbell and Cahill 1996) (Figure 32). This potential problem can be avoided by conducting burns only in more isolated regions. Public relations problems can be minimized by educating residents of the intended goals of the project prior to the burn.

Another major risk of prescribed burning is the possibility of fire escapes. This is particularly true when burns are conducted during the summer months. This can be minimized by proper preparation and through involvement of local, state, and federal fire departments.

Because of these air quality and fire escape concerns, public agencies restrict prescribed burns to periods of proper wind, humidity, and temperature conditions. Burns are usually regulated by county air pollution control districts, which can allow or deny burn permits depending on climatic conditions. Given these restrictions, plus the ever-present possibility of variable weather during desired burn periods, it can be problematic to achieve a burn within the time period required for weed control.

County agencies should be the first point of contact when planning for a burn. These agencies also coordinate with state and federal fire protection agencies, which can sometimes provide personnel to conduct prescribed burns for training exercises.

Another potential risk is that too-frequent burning may increase soil erosion and impact the plant composition within a site. Species that complete their life cycle before the burn will be selected for, while those with later flowering times will be

Figure 32. Prescribed burn at the urban interface

This prescribed burn in the Boise foothills was carefully monitored to minimize the risks of smoke exposure and fire escape. (Photo: Ryan Steineckert, Eastern Oregon Agricultural Research Center, Burns, OR) selected against. In some areas, burning can lead to rapid invasion by other undesirable species with wind-dispersed seeds, particularly members of the Asteraceae (sunflower family). Although this is a potential concern, and a few desirable plant species are negatively affected by repeated burning, populations of most native species on low-elevation sites are enhanced by burns (DiTomaso et al. 1999).

Burning has a more negative impact on native species of high-elevation sagebrush rangeland. Great Basin ecosystems are adapted to a regime of infrequent fires – on the order of one burn per 100 to 200 years – and sagebrush and other shrubs in these areas do not recover quickly after a burn. Native bunchgrasses are also growing during the optimum timing for burning to control medusahead, and these species are much more sensitive to fire during the growing season than after senescence. Thus, introduction of burning at too-frequent intervals can result in the conversion of shrubland into land dominated by invasive annual grasses such as medusahead and downy brome (Figure 33). In addition, as discussed above, burning is less effective for medusahead control in these areas.

One other aspect of burning to consider is the short-term loss of grazeable forage. Ranchers who normally graze their stock on the dry residual forage during late spring to early fall may be reluctant to use prescribed burning for medusahead control because of the economic costs of burning off the dry forage. Forage production in the following year may also be reduced by 50% to 70% (Bechetti et al. 2011).

Figure 33. High-elevation shrubland *is poorly adapted to fire. Too-frequent burning in these ecosystems can allow medusahead to replace shrubs, as on this rangeland in eastern Oregon. (Photo: Bonnie Rasmussen, Oregon Department of Agriculture)*

Revegetation

The goals of a revegetation program are (1) to restore ecosystem services (such as forage, habitat, etc.) that have been lost due to declines in desirable plant species, and (2) to competitively exclude invasive plants from invading or reinvading the site. On rangelands infested with medusahead, ranchers would most likely initiate a revegetation program to increase more productive and desirable forage. Revegetation programs, however, are generally expensive and are not often conducted in areas where the economic return on the land is low.

In successful revegetation programs where medusahead is a problem the seeded species are typically perennial grasses. These species should be functionally similar to medusahead in the ways they acquire various resources, in order to limit the resources available to medusahead (Davies 2008; James et al. 2008; Nafus and Davies 2014). While this can reduce the population of medusahead by shifting the competitive advantage to more desirable species, particularly perennial grasses, it is unlikely to eliminate medusahead (Clausnitzer et al. 1999; Mangla et al. 2011; Young et al. 1999). In addition, some studies have shown that invasive annual grasses, such as medusahead, are more competitive than native perennial grasses even under low resource availability (James 2008a, 2008b; Monaco et al. 2003a), especially at the seedling stage (James et al. 2011a). However, depending on the species, low resource availability can also reduce the competitiveness of medusahead with perennial grasses. For example, while drought limited the successful establishment of native perennial bunchgrasses (Clausnitzer et al. 1999), it had an even greater effect on the establishment and competitiveness of medusahead (Mangla et al. 2011).

Nitrogen (N) availability can also greatly influence the competitive interaction between medusahead and perennial grasses. Many native perennial grasses are adapted to low soil N. While natives may not grow as vigorously under low N conditions, they can do better than medusahead. Low N levels limit medusahead growth to a level where perennial grasses compete more successfully (James et al. 2011a;

Monaco et al. 2003a). In support of this, Brunson et al. (2010) showed that biomass and seed production of medusahead were reduced at low N levels. Although it is possible to reduce N availability in the soil by applying barley straw, sucrose, or sawdust (Alpert and Maron 2000; Brunson et al. 2010; Monaco et al. 2003a), these practices are only temporary and are too expensive to conduct on a large scale (Nafus and Davies 2014).

In nearly all cases, revegetating with more desirable species will require pretreatment or concurrent treatment with some weed management practice. This can include the use of herbicides (Monaco et al. 2005), prescribed burning (Kyser et al. 2008), or a combination of control options, including burning followed by herbicide treatment (Sheley et al. 2012b). Weed control practices which also remove medusahead thatch (i.e., burning, tillage, and sometimes mowing or grazing) are most likely to result in successful establishment of revegetation plantings.

Even with adequate control, revegetation programs in rangelands often fail due to a number of factors (James et al. 2011b; Young 1992). For example, sites with high clay content and shrink-swell potential favor medusahead over perennial grasses, and thus reinvasion over time is inevitable even after the use of successful control methods (Sheley et al. 2008; Stromberg and Griffin 1996). More often, however, climatic conditions such as dry summers or unpredictable winter and spring rainfall can impact the success of establishing desirable perennial grasses (Young et al. 1999).

Plant selection

Another aspect of revegetation is selecting the proper plant species to include in the mix. While many restorationists would prefer to revegetate with native species, they can be expensive, more difficult to obtain and establish, and often less resistant to reinvasion (Arredondo et al. 1998; James et al. 2011b; Nafus and Davies 2014). Thus, the risk of failure is generally greater with native species. Success of revegetation with natives can vary with location. For example, in the Intermountain West, the likelihood of successfully establishing native species increases as sites become cooler and wetter (Nafus and Davies 2014).

Some native species have a better probability of establishment than others. For example, squirreltail species, including *Elymus multisetus* and *E. elymoides*, have considerable ecotypic variability and have been relatively easy to establish in many areas of the western US (Arredondo et al. 1998; Hironaka and Sindelar 1975; Hironaka and Tisdale 1963; Leger 2008; Young 1992; Young and Mangold 2008). Although squirreltail establishes well in the absence of medusahead, it is not a strong competitor with medusahead, especially in the seedling stage (Harris and Wilson 1970; Young and Mangold 2008). As a side note, the squirreltail inflorescence somewhat resembles that of medusahead and can be hard to distinguish without practice (Figure 34).

Bluebunch wheatgrass (*Elymus spicatus*) is another native bunchgrass which establishes well and can be used to revegetate sites after medusahead has been controlled (Figure 35). Like squirreltail, however, bluebunch wheatgrass is a relatively weak competitor with medusahead (Goebel et al. 1988; Harris 1977), particularly under grazing (Sheley and Svejcar 2009). Other native perennial grasses sometimes used in restoration projects include thickspike wheatgrass (*E. lanceolatus*), slender wheatgrass (*E.*

Figure 34. Squirreltail
(Photo: Matt Lavin, Montana State University) →

Figure 35. Bluebunch wheatgrass

(Photo: Matt Lavin, Montana State University) →

trachycaulus), basin wildrye (*Leymus cinerus*), beardless wildrye (*L. triticoides*), and western wheatgrass (*Pascopyrum smithii*).

Introduced perennial grasses such as crested wheatgrass (*Agropyron cristatum*) (Figure 36) are commonly used in revegetation programs in the Intermountain West. Though not native, crested wheatgrass has several benefits compared to native species. It is less expensive, germinates readily, establishes with a higher level of success, and is more competitive with medusahead compared to most native species (Boyd and Davies 2010; Davies et al. 2010; Eiswerth et al. 2009; James et al. 2011b). This is one of very few perennial grasses able to establish even in an uncontrolled medusahead infestation (Wilson et al. 2010). In addition, crested wheatgrass can provide similar ecosystem function as more desirable native species (Davies et al. 2011).

Revegetating with crested wheatgrass poses some problems, however. In addition to competing with medusahead, it can be competitive with native plants and can reduce plant diversity in areas where it establishes successfully (Asay et al. 2001; Hull and Klomp 1967). In some parts of the northern Great Plains, crested wheatgrass is considered to be invasive in mixed-grass prairie (e.g., Henderson and Naeth 2005). In some areas, crested wheatgrass has also been found to reduce wildlife habitat (McAdoo et al. 1989; Reynolds and Trost 1981; Sutter and Brigham 1998).

Other nonnative perennial grasses, including desert wheatgrass (*Agropyron desertorum*), smooth brome (*Bromus inermis*), hybrid wheatgrass (*Elymus hoffmannii*), Russian wildrye (*Psathyrostachys juncea*), intermediate or pubescent wheatgrass (*Thinopyrum intermedium*; = *Elymus hispidus*), and tall wheatgrass (*Thinopyrum ponticum*), have also been used in revegetation programs to suppress medusahead. These species generally don't attract the same degree of criticism as crested wheatgrass (although some consider desert and crested wheatgrass to be variants in the same species). Young et al. (1969b) was successful in establishing intermediate wheatgrass in a medusahead-infested area of the Great Basin. This required a summer fallow followed by disk harrowing. However, even this successful treatment did not completely exclude medusahead.

Figure 36. Crested wheatgrass

(Photo: Matt Lavin, Montana State University) →

Recent research suggests that early successional ("ruderal") species, such as native annual forbs and grasses, may establish more successfully than the late-successional perennial grasses typically used in Great Basin revegetation projects (Uselman et al. 2014) (Figure 37). These species are also very competitive with medusahead. This appears to be a promising area for future research.

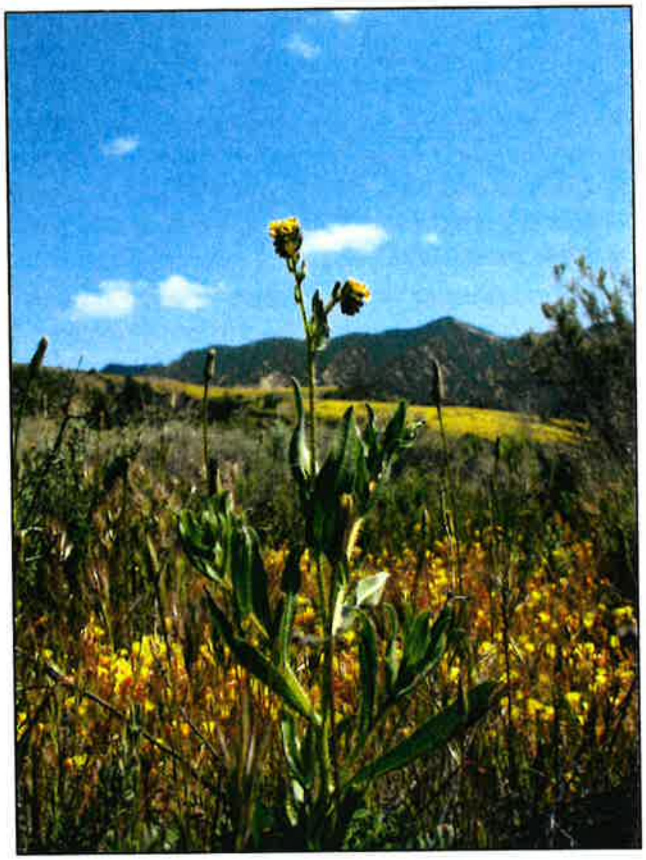

Figure 37. Native annual species
*may be useful in revegetation. Early successional species like bristly fiddleneck (*Amsinckia tessellata*) are competitive with medusahead and can be easier to establish than perennial grasses. (Photo: Brent Miller, CalPhotos) →*

Figure 38. Soft chess
This is a palatable annual grass adapted for drought and grazing conditions. (Photo: Josh Davy)

If early successional natives can be established on medusahead-infested sites, they may serve as a bridge community which improves the viability of later revegetation efforts.

Unlike the Intermountain West and Great Basin areas of the western US, low-elevation California rangelands are dominated by nonnative winter annual grasses. Many of these grasses, particularly soft chess (Figure 38), slender oat and wild oat, and rye grass (Figure 39), are considered excellent forage grasses and desirable species for ranchers. Seed of soft chess (cultivar 'Blando Brome') and rye grass are almost always commercially available and inexpensive. Slender and wild oat seeds are not generally available for purchase because the seedheads shatter quickly in the field. These species, which occupy the

Figure 39. Rye grass
Another useful annual grass.

Figure 40. Orchardgrass
A cool-season perennial which is competitive on low-elevation rangeland. (Photo: Josh Davy)

same root zone as medusahead, are very competitive with noxious annual grasses (Kyser et al. 2008).

Warm-season perennial grasses such as wheatgrasses, which are dormant during winter, have not been found to compete successfully with invasive annual grasses on low-elevation rangeland. At low elevations, winter annual species – including invasive grasses such as medusahead – are well-established by the time warm-season grasses begin to grow, and most low-elevation rangelands don't retain enough soil moisture to support grasses during the hot, dry summers. However, Borman et al. (1991) demonstrated successful competition against annual grasses using cool-season perennial grasses that initiate growth in fall and continue through winter. One example was the introduced species orchardgrass (*Dactylis glomerata* var. 'Berber') (Figure 40). Orchardgrass, like many of the perennial grasses native to lower elevations, has strong summer dormancy to help survive the dry season.

Economics

The primary limitation to the use of native species in revegetation programs is their high cost. Few producers are available and the demand for seed is low. This increases the cost of seed and reduces availability of genetically endemic biotypes of native species. Genetic races of native grasses have been found to be very different in their performance and phenology, making it important to select the appropriate plant material for the selected site (Adams et al. 1999). This is difficult to achieve given the limited number of native seed producers.

In many cases, the cost of using native seed can be in the hundreds to even thousands of dollars per acre. Access to seeding equipment can also be a major limitation. Drill seeders are expensive, specialized equipment, often unavailable, and cannot be used in steep terrain. Broadcast seeding reduces the chances of successful establishment.

In one example of the costs of revegetation, native legumes and perennial grasses were planted at Fort Hunter Liggett, CA. In this project, seed cost between \$500 and \$2,000 per acre (\$1,235 to \$4,940 ha^{-1}) (A. Hazebrook, Fort Hunter Liggett, pers. comm.). Native species comprised 5 to 30% of total vegetative cover two years after seeding.

Revegetation methods and timing

Revegetation can be accomplished by broadcast seeding into existing communities, or by drill seeding into disked, herbicide-treated, or no-till rangeland. Drill seeding programs are considerably more successful than those utilizing broadcast seeding techniques. Rangeland drill seeders (Figure 41) are designed to deal with uneven terrain and long-awned seed species.

Broadcast seeding disperses seeds on the top of the soil, so the seeds are more susceptible to predation or decay. In addition, if the seeds germinate on the soil surface they have a higher probability of desiccating under subsequent dry conditions. In addi-

Figure 41. Rangeland drill seeder

tion, medusahead thatch can limit the amount of broadcast seed that reach the soil. Broadcast seeding is more successful if seeds can be lightly incorporated by harrowing.

On low-elevation rangeland, weed control is the primary factor to consider before seeding, especially with perennial grasses. Seeding in early fall can result in the best establishment if there is autumn rainfall to initiate germination before winter. However, if the weather turns cold before enough rainfall occurs, perennial grasses may not germinate until late winter or early spring. This is not as great a problem when seeding with annual grasses, which are better able to establish in cold temperatures. Another risk with fall seeding is the event of an early autumn rainfall followed by a period of dry weather. Seeded species may germinate with the first rains, then dry out before they can establish. However, many perennial grasses have delayed or staggered germination, which may help to ameliorate episodic rainfall events.

If it is possible to access the site in January or February, this planting time can be successful if followed by sufficient spring rainfall. The gamble with a late winter seeding is that cold conditions may suppress germination until early spring, making the success of the planting entirely dependent on spring rainfall. The advantage of late winter seeding is that it allows additional time for weed control prior to planting. In addition, if spring rainfall continues while the weather is warming up, plants can establish quickly.

On Great Basin rangeland, reseeding in spring (February to early April) generally gives better results than seeding in fall (R.G. Wilson, pers. comm.). If seeded in fall, most species grow slowly during the cold months and often undergo high winter mortality (Boyd and James 2013). (Nevertheless, fall seeding is often quite successful with crested wheatgrass.) However, seeding is most often done in fall because it is logistically easier. In the Great Basin it may be too muddy to seed at the optimal time in spring, and seeding may be delayed until too little moisture is left for establishment. Alternatively, less successful methods such as broadcast seeding may be used.

Biological Control

In their native range, most species are kept in check by a variety of co-evolved organisms, including pathogens, insects, and predators (or herbivores). Once introduced to a new region, a species may leave behind many of its natural enemies. In the absence of natural controls, a new species may become invasive. In classic biological control, natural enemies in the native range are identified, collected, and tested for host specificity and effectiveness. The Biological Control of Pests Research Unit of USDA, which usually conducts biological control search-and-release programs, performs extensive testing to make sure that these potential biocontrol agents are host-specific. Those that prove very host-selective and that cause significant damage to pests under controlled conditions are then considered for release in the invasive species' new domain. Most such biocontrol agents are insects.

There are currently no successful biological control agents available for managing medusahead. Because of its close taxonomic relationship to wheat, barley, and rye, biological control of medusahead faces intense scrutiny, and finding a safe and reliable biocontrol organism may not be possible (Sforza et al. 2004). Nevertheless, the large-scale economic and ecological impacts attributed to medusahead have led to several attempts to identify potential biocontrol organisms. All of these have focused on pathogens rather than insects. Many of these are fungi that cause crown and root rot or infect the leaves of medusahead (Chagorova 1960; Holubec et al. 1997). While they have been successful in reducing medusahead seed production, most have not proven to be host specific and several have, to some degree, damaged some desirable native grasses and important cereal grain crops (Berner et al. 2007; Grey et al. 1995; Siegwart et al. 2003).

One species evaluated as a potential biological control agent against medusahead was the fungus *Fusarium arthrosporioides* (syn. *F. roseum* var. *arthrosporioides*), first isolated from the leaf collar of medusahead in Greece (Siegwart et al. 2003). In laboratory studies, it was found to inhibit normal root development and cause leaf discoloration (Siegwart et al. 2003). However, the fungus was also found to infect wheat, barley, oat and other desirable grasses and is no longer being considered as a potential biocontrol agent. Another crown rot fungus, *F. culmorum*, had a significant impact on drought-stressed medusahead, but it also was not host specific (Grey et al. 1995).

Among the more promising organisms is the systemic ovary-smut fungus *Ustilago phrygica*, collected from Turkey, Cyprus and Bulgaria. It exhibits typical smut symptoms on medusahead under both greenhouse and field conditions (Figure 42) and has not been observed to infect cultivated cereals (Sforza et al. 2004). However, it has not been widely tested on other grass species and it is not available for use.

Ongoing work continues to focus on a rhizobacterium, *Pseudomonas fluorescens* strain D7 (*Pf*D7). This organism has been effective on medusahead in laboratory studies (Kennedy et al. 2001) and is currently being tested in the field with some promising results. Because it is native to the western US, the time-consuming and costly permitting process is not necessary. *Pseudomonas fluorescens* has also provided some suppression of downy brome and jointed goatgrass, two other important grass weeds, while impacting only a few other monocots and no dicots.

Figure 42. Smut fungus on medusahead

The potential biocontrol agent Ustilago phryigica *attacks the medusahead inflorescence. (Photo: Rene Sforza, USDA-ARS, European Biological Control Laboratory)*

Chapter 7: Chemical Control Methods

Herbicides are widely used for controlling weeds, though less often in rangeland and wildland settings than in conventional agriculture. The particular problems in using herbicides to control medusahead include (1) the difficulty in selectively controlling medusahead without causing damage to desirable forage grasses or other plant species; and (2) the economic costs of large-scale application on land with a relatively low rate of return.

Figure 44. ATV application

Herbicide Application Techniques

Herbicides can be applied on rangeland and grassland by a number of methods, including aerial applications (using fixed-wing aircraft or helicopters), ground vehicle applications, and backpack sprayers. Whatever application method is used, the operator will achieve the best selectivity and the most cost-effective results by using equipment which is properly calibrated to deliver known, consistent rates.

Figure 43. Aerial treatment of medusahead
Willow Creek watershed, Lassen County, CA. (Photo: Robert G. Wilson, UCCE)

Aerial broadcast applications can cover the greatest area in the shortest time, but they are susceptible to drift and have limited targeting ability. Under good weather conditions, and using GPS to leave buffers around sensitive areas, aerial applications can be performed safely and are the most efficient means of treating large areas (Figure 43).

Ground vehicle applications are made using ATVs or truck sprayers (Figure 44). These are appropriate for smaller infestations, where terrain permits. Ground applications have a lower risk of drift than aerial applications and can be applied in a more directed manner. They can be particularly effective for cleaning up buffer zones following large-scale aerial treatments.

Backpack sprayers can be outfitted with booms for small-scale treatments (Figure 45). These treatments can be very selectively applied and

Figure 45. Backpack application
(Photo: David Bakke, USFS)

present a low risk of drift. However, they are not efficient for treating large areas. Backpack treatments are most effective for cleanup of small infestations, especially on terrain too rugged for vehicle applications.

Risks

The potential risks associated with herbicide use have been widely publicized both in the scientific literature and the popular press. Although these risks are often greatly exaggerated, improper use of herbicides can cause problems such as spray or vapor drift, water contamination, animal or human toxicity, selection for herbicide resistance in weeds, and reduction in plant diversity.

Spray and vapor drift

Herbicide drift may injure susceptible crops, ornamentals, or non-target native species. Drift can also cause non-uniform application in a field and/or reduce efficacy of the herbicide in controlling weeds (DiTomaso 1997). Several factors influence drift, including spray droplet size, wind and air stability, humidity and temperature, physical properties of herbicides and their formulations, and method of application. For example, the amount of herbicide lost from the target area and the distance it moves both increase as wind velocity increases. Under inversion conditions, when cool air is near the surface under a layer of warm air, little vertical mixing of air occurs. Spray drift is most severe under these conditions, since small spray droplets fall slowly and can move to adjoining areas even with very little wind. Low relative humidity and high temperature cause more rapid evaporation of spray droplets between sprayer and target. This reduces droplet size, resulting in increased potential for spray drift.

Another type of drift can occur when certain residual herbicides are applied to dry, powdery soil which blows off-site. The preemergence herbicides in the ALS inhibitor family, discussed below, can pose a risk of moving with blown soil.

Vapor drift can occur when an herbicide volatilizes. The formulation and volatility of the compound determine its vapor drift potential. Potential of vapor drift is greatest under high temperatures and with ester formulations. Most herbicides used for medusahead control do not pose a high risk of volatilization.

Nozzle height depends on the type of application (e.g., airplane, helicopter, ground sprayer) and determines the distance a droplet falls before reaching the weeds or soil. Greater application heights, such as aerial applications, result in more potential for drift. For one thing, the droplets are in the air for a longer time. In addition, wind velocity often increases with elevation above the ground. Finally, aerial applications are more likely to be above any inversion layer, which inhibits downward movement of herbicide droplets and increases the potential for long-distance drift. However, studies have found that careful aerial applications with 100-ft (30-m) buffers around sensitive areas can be performed with minimal drift (e.g., DiTomaso et al. 2004).

A number of measures can be taken to minimize the potential for herbicide drift. Chemical treatments should be made under calm conditions, preferably when humidity is high and temperatures are relatively low. Ground equipment (versus aerial equipment) reduces the risk of spray drift, and rope wick or carpet applicators nearly eliminate it. Use of the correct formulation under a particular set of conditions is important. For example, if long-residual preemergence herbicides must be applied on a site with loose, dry soil, this should be done after a recent rainfall or when precipitation is expected. (But not when the forecast predicts heavy rain to the point of runoff – see below.)

Groundwater and surface water contamination

Most herbicide groundwater contamination results from "point sources." Point source contaminations include spills or leaks at storage and handling facilities, improperly discarded containers, and rinsing equipment in loading and handling areas, e.g., into adjacent drainage ditches. Point sources are characterized by discrete locations discharging relatively high local concentrations. These contaminations can be avoided through proper calibration, mixing, and cleaning of equipment.

Non-point source groundwater contaminations of herbicides are relatively uncommon. They can occur, however, when a soil-mobile herbicide is applied in an area with a shallow water table. In this situation, the choice of an appropriate herbicide or alternative control strategy can prevent contamination of the water source.

Surface water contamination can occur when herbicides are applied intentionally or accidentally into ditches, irrigation channels or other bodies of water, or when soil-applied herbicides are carried away in runoff to surface waters. Herbicide may be applied directly into surface water for control of aquatic species. In this case, there is a restriction period prior to the use of this water for human activities. In many situations, alternative methods of herbicide treatment, including rope wick application, will greatly reduce the risk of surface water contamination when working near open water.

Loss of a preemergence herbicide through erosion may occur when a heavy rain follows a chemical treatment. Herbicide runoff to surface waters can be minimized by monitoring weather forecasts before applying herbicides. Application of preemergence herbicides should be avoided when forecasts call for heavy rainfall. However, moderate precipitation between 0.5 and 1 inch (1.3 to 2.5 cm) helps a preemergence herbicide to percolate into the soil profile, thus minimizing the subsequent risk of surface runoff.

Toxicology

When used improperly, some herbicides can pose a health risk. This can be minimized with proper safety techniques. Applicators should follow label directions and wear appropriate safely apparel. This is particularly important during mixing, when the applicator is exposed to the highest concentration of the herbicide. Although animals can also be at some risk from herbicide exposure, most herbicides registered for use in noncrop areas, particularly natural ecosystems, are relatively nontoxic to wildlife. To prevent injury to wildlife, care should be taken to apply these compounds at labeled rates.

The trend in herbicide toxicity of the past 25 years has been toward registration of less toxic compounds. From 1970 to 2014, the number of registered herbicides with an LD_{50} (dose in mg herbicide kg^{-1} animal weight lethal to 50% of male rats) below 500 mg kg^{-1} decreased from 17 compounds to 8, while herbicides in the least toxic category (LD_{50} >5000 mg kg^{-1}) increased from 20 compounds to 50. The average LD_{50} of herbicides registered in the United States increased from 3031 to 3803 mg kg^{-1} (Weed Science Society of America 1970, 2014).

Most herbicides used on rangelands and wildlands, particularly preemergence chemicals, are applied at very low rates, just a few ounces of active ingredient per acre. This is a significant change from the early days of herbicide usage, when rates of up to several pounds of active ingredient per acre were commonly applied.

Herbicide resistance

Selection for herbicide-resistant weed biotypes is greatly accelerated by continuous use of herbicides, particularly those with a single mode of action. Though resistance has not been reported for medusahead, another species in the medusahead tribe of grasses (Triticeae), hare barley (*Hordeum murinum*), has developed resistance to ACCase (acetyl Co-A carboxylase) inhibitors such as clethodim and fluazifop, and ALS (acetolactate synthase) inhibitors such as sulfometuron. Resistance in this species was first detected in 1996 in Australia, according to the International Survey of Herbicide Resistant Weeds (Heap 2014). Other less closely related grasses showing resistance to herbicides in various locations include oats (*Avena* spp.), bromes (*Bromus* spp.), barnyardgrass (*Echinochloa* spp.), sprangletops (*Leptochloa* spp.), ryegrass (*Lolium* spp.), panicums (*Panicum* spp.), canarygrass (*Phalaris* spp.), foxtails (*Setaria* spp.), and johnsongrass (*Sorghum halepense*).

In general, the risk of herbicide resistance developing in weeds of rangeland and wildland is much lower than the risk in weeds of intensive agriculture, because uncultivated areas tend not to receive the same herbicide treatment year after year. We do have concerns about the potential for resistance developing following treatment with low rates of glyphosate, as described in Table 4. Overreliance on this method might select for medusahead biotypes with some degree of glyphosate resistance, which could develop into resistant populations over the course of a few years. However, this would likely require multiple years of treatment with glyphosate. With any herbicide control strategy, using integrated approaches which include other control methods can greatly reduce the incidence of herbicide resistant biotypes.

Effects of herbicides on plant diversity

The benefits of medusahead control with herbicides must be weighed against the possible impacts on other species. When herbicides are used carefully, this impact can be positive. For example, in one study in the Great Basin, a one-time application of imazapic both controlled medusahead and resulted in increased cover of native forbs (Kyser et al. 2013).

However, continuous broadcast use of a single type of herbicide will select for the most tolerant plant species. In the absence of a healthy plant community composed of desirable species, one noxious weed may be replaced by another equally undesirable species insensitive to the herbicide treatment. For example, the indiscriminate use of broadleaf herbicides to control yellow starthistle can lead to an increase in undesirable annual grasses such as medusahead, ripgut brome, downy brome, or barb goatgrass.

Population shifts through repeated use of a single herbicide may also reduce plant diversity and cause nutrient changes that decrease the total vigor of the range (DiTomaso 1997). For example, legume species are important components of rangelands, pastures, and wildlands, and are highly sensitive to aminopyralid. Repeated use of aminopyralid over multiple years may have a long-term detrimental effect on legume populations. Herbicide use on rangelands is generally more successful when incorporated as part of an integrated weed management system.

Methods and Timing

As with other control methods, the goal of using herbicides to control medusahead is to prevent the plants from producing seed. This can be accomplished with either preemergence herbicides or postemergence herbicides.

Postemergence herbicides are applied in spring to growing plants. On high-elevation rangeland, small medusahead plants can be controlled with low rates of the nonselective herbicide glyphosate; these rates are relatively safe for established perennials (Table 4). Glyphosate can also be used at high rates to control medusahead in low-elevation annual grassland in late spring after most other species have senesced. Selective herbicides that control only grasses are available (Table 6), but these are not widely used on rangeland (and pose a risk of injury to other, more desirable grass species).

Preemergence herbicides are applied to the soil in fall before medusahead germinates (Table 5 and Table 7). On roadsides and in industrial areas, nonselective preemergence herbicides are sometimes used to control all vegetation. However, on rangeland the goal is to control medusahead while leaving as much of the desirable vegetation as possible. The ideal selective herbicide would control 100% of the medusahead without affecting any other species, but this is essentially impossible to achieve. Most of the preemergence herbicides used for managing medusahead on rangeland are somewhat selective, but all are likely to have some effect on at least some other plant species.

Table 4. Glyphosate

Glyphosate is a nonselective, foliar-applied herbicide originally patented under the name *Roundup®*. Glyphosate is in the herbicide family of aromatic amino acid inhibitors. It is nonselective (high rates will kill most plants) and has no soil residual, so plants emerging after application will not be controlled. Note that glyphosate is available in many formulations with different concentrations. Rates given here are for 41% glyphosate product [3 lb acid equivalent (a.e.) /gallon].

In Great Basin shrub ecosystems, low rates of glyphosate can be applied over-the-top of native perennial species. Applied ideally at the tillering stage of medusahead, these rates are high enough to control immature medusahead plants but not high enough to injure established perennials (Kyser et al. 2012a) (Figure 46). On low-elevation annual rangeland, glyphosate can be applied at higher rates to medusahead in the early flowering stage. At this timing, similar to the best timing for mowing or grazing, most forage species have already completed their life cycle. As a result, glyphosate can prevent medusahead seed production without damage to desirable plants (T. Becchetti, personal communication). In revegetation projects, glyphosate can be applied to control emerged weeds at the time of seeding; this is only recommended when there are very few desirable species present.

Prices are for comparison only. Actual prices can vary greatly by region, point of sale, and time of year.

Glyphosate *Roundup Pro*, *Accord XRT*, and others	**Rate:** 0.75 to 1 pt product (41% glyphosate)/acre (4.5 to 6 oz a.e./acre) for early-season selective control in shrubland or other perennial systems; 1 to 2 qt product/acre (0.75 to 1.5 lb a.e./acre) for late-season, non-selective control. **Cost (2014)**[1]**:** $16/gal (~$2/acre for early-season treatment, ~$4 to $8/acre for late-season treatment) **Timing:** For selective control in shrubland, apply postemergence in spring after all seedlings are up and before heading; the tillering stage is ideal. For late-season, non-selective control, apply to rapidly growing plants before seeds are produced. **Remarks:** Glyphosate is a non-selective herbicide with no soil activity.

[1] Ferrell and Sellers (2014)

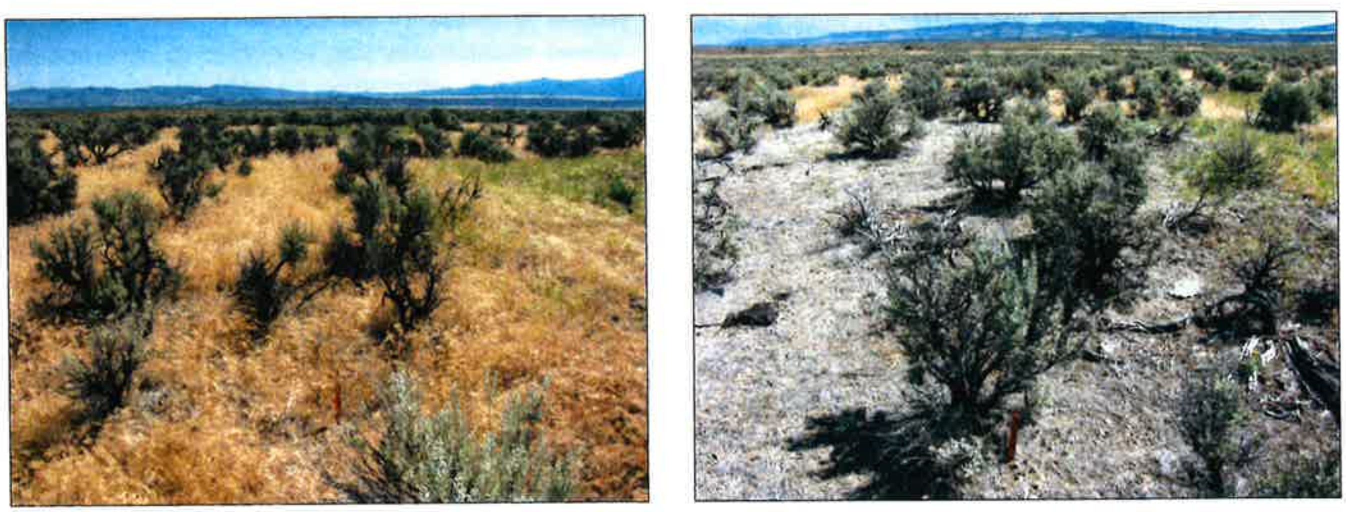

Figure 46. Great Basin sagebrush steppe trial

Untreated plot (left) vs. plot treated with a low rate of glyphosate at medusahead tillering stage (Kyser et al. 2012a). (Photos: Alan Uchida, US-BLM, Alturas, CA)

Table 5. Preemergence herbicides

Preemergence chemicals have soil residual activity of up to several months, and generally require some rainfall to move into the soil. The herbicides listed here are in the family of ALS inhibitors. These are usually applied in fall, before medusahead emerges. Their residual activity breaks down more quickly in warm environments, so these chemicals tend to be most useful in cold-winter intermountain ecosystems. None are perfectly selective, but most are safe on established perennial grasses and shrubs. Drawbacks include

- most have plantback and/or grazing restrictions
- selectivity and efficacy may vary with soil type, presence of thatch, and moisture conditions.

Prices are for comparison only. Actual prices can vary greatly by region, point of sale, and time of year.

Imazapic *Plateau* *Panoramic 2SL*	**Rate:** 4 to 12 fluid oz product/acre (1 to 3 oz a.e./acre) **Cost (2013)**[1] **:** $165/gal (~$5 to $15/acre) **Timing:** Fall or spring. In warm-winter areas, fall applications may be most effective. In colder climates, spring applications after snow melt are better. **Safety on established perennial grasses:** Safe **Plantback interval:** 8 months **Grazing restriction:** None **Remarks:** Has some soil residual activity and mixed selectivity. Safe on Asteraceae and established grasses, so it is useful on intermountain rangeland where the goal is not to damage sagebrush or perennial grasses. Use a spray adjuvant for postemergence applications. Effects vary depending on soil texture and soil organic matter. Heavy soils and high organic matter may require higher rates. Can tie up in litter, and efficacy is reduced where there is lots of thatch on the soil surface; activity is improved by burning or other thatch removal before application. Also available mixed with glyphosate (sold as *Journey*). Not registered for use in California.
Rimsulfuron *Matrix SG* *Matrix FNV*	**Rate:** 4 oz product/acre (1 oz active ingredient (a.i.)/acre) **Cost (2014)**[2] **:** $15/oz (~$60/acre) **Timing:** Preemergence (fall) to early postemergence (early spring) **Safety on established perennial grasses:** Fall applications are safe for established perennial grasses grown under dryland conditions. Application to rapidly growing or irrigated perennial grasses may result in their injury or death. **Plantback interval:** 7 to 12 months **Grazing restriction:** 1 year **Remarks:** Controls several annual grasses and broadleaves. It provides soil residual control in cool climates but degrades rapidly under warm conditions. Add a surfactant when applying postemergence.
Sulfometuron *Oust XP* and others	**Rate:** 0.75 to 1.5 oz product/acre (0.56 to 1.13 oz a.i./acre) **Cost (2014)**[2] **:** $88/lb (~$4 to $8 per acre) **Timing:** Preemergence to early postemergence. Preemergence (fall) applications are generally more effective. **Safety on established perennial grasses:** Minor injury possible **Plantback interval:** 3 to 6 months **Grazing restriction:** 1 year **Remarks:** Broad-spectrum herbicide that is fairly safe on native perennial grasses. Use lower rates in arid environments, higher rates in wetter areas (>20 inches rainfall) and on high organic matter soils. It has fairly long soil residual activity. Use caution when ap-

	plying on dry, powdery soils – when bound to light soils, this chemical can blow in the wind and cause off-site damage. Sulfometuron was found to produce long-term reductions in native forb populations in one study in Oregon (Louhaichi et al. 2012).
Sulfometuron + chlorsulfuron *Landmark XP*	**Rate:** 1.5 to 2.25 oz product/acre **Cost (2014)**[3] **:** $13/oz (~$19 to $29 per acre) **Timing:** Preemergence, in fall or after soil thaws in spring. **Safety on established perennial grasses:** Minor injury possible **Plantback interval:** 3 to 6 months **Grazing restriction:** 1 year **Remarks:** See sulfometuron.

[1] North Dakota State University (2013)
[2] Ferrell and Sellers (2014)
[3] eVegetationmanager (2014)

Table 6. Grass-selective herbicides

These chemicals are in the herbicide family of ACCase inhibitors. They control most grasses but will not affect most broadleaf plants. These herbicides are applied postemergence to young, growing plants. They have no soil residual, so plants emerging after application will not be controlled. Some users report that these herbicides are safe for established bunchgrasses, when applied at low rates (e.g., Bell et al. 2013). However, we recommend *extreme caution*, and a small trial application, when trying to use these herbicides for selectively controlling medusahead in a perennial grass system.

Prices are for comparison only. Actual prices can vary greatly by region, point of sale, and time of year.

Clethodim *Arrow 2EC*	**Rate:** 4 to 8 fluid oz product/acre (1 to 2 oz a.e./acre) **Cost (2013)**[1] **:** $120/gal (~$4 to $8/acre) **Timing:** Early postemergence **Safety on established perennial grasses:** May vary by species and growth stage. Older, established bunchgrasses should be safe but may show injury. Annual grasses will be severely injured or killed. **Plantback interval:** None **Grazing restriction:** Depending on the type of application, label restrictions vary all the way from no restriction to "Do not graze." Check with your county before use. **Remarks:** Registered for use on noncrop, fallow ground, and native prairie restoration projects. Check with your county to make sure your intended use is permitted.
Fluazifop *Fusilade DX*	**Rate:** 24 fluid oz product/acre (6 oz a.e./acre) **Cost (2014)**[2] **:** $170/gal (~$32/acre) **Timing:** Early postemergence **Safety on established perennial grasses:** May vary by species and growth stage. Older, established bunchgrasses should be safe but may show injury. Annual grasses will be severely injured or killed. **Plantback interval:** None **Grazing restriction:** do not graze for 12 months after application **Remarks:** Registered for use on noncrop and fallow ground; 24(c) registration for wildland in California and Oregon. Check with your county to make sure your intended use is permitted.

[1] North Dakota State University (2013)
[2] Ferrell and Sellers (2014)

Table 7. Growth regulator herbicides

Most growth regulator herbicides are broadleaf-selective, but recent research has found that two of these chemicals can be used to control medusahead. These herbicides are usually applied preemergence in fall, and have soil residual activity for several months. These chemicals will injure or kill some broadleaf species, including most legumes. Legumes should recover from the seedbank in the years following the application. Unlike the preemergence herbicides discussed above, these chemicals are not affected by thatch.

Prices are for comparison only. Actual prices can vary greatly by region, point of sale, and time of year.

Aminocyclopyrachlor + chlorsulfuron *Perspective*	**Rate:** 5 oz product/acre (2 oz aminocyclopyrachlor + 0.8 oz chlorsulfuron/acre) **Cost (2014)**[1]**:** $80/lb (~$25/acre) **Timing:** Preemergence to early postemergence **Safety on established perennial grasses:** Safe, but can injure young grasses. Some other young annual grasses may be injured, but most major forage grasses are not affected. **Plantback interval:** 12 months **Grazing restriction:** Under current label, do not graze treated forage; this may change on future labels. **Remarks:** Newly registered; check with your county to make sure your intended use is permitted. A broadleaf-selective herbicide – very effective on thistles – that is safe on most grasses. Can injure trees if applied in the root zone. Aminocyclopyrachlor is also available in a mix with metsulfuron (*Streamline* – not registered for use in California).
Aminopyralid *Milestone*	**Rate:** 7 to 14 fluid oz product/acre (1.75 to 3.5 oz a.e./acre) **Cost (2014)**[1]**:** $300/gal (~$16 to $33/acre) **Timing:** Preemergence in fall **Safety on established grasses:** Safe, but can injure young grasses. Some other young annual grasses may be injured, but most major forage grasses are not affected. **Plantback interval:** We recommend 1 to 3 months for grasses, and 1 to 2 years for legumes. **Grazing restriction:** None **Remarks:** Broadleaf-selective – very effective on thistles – and safe on most grasses. There is a 2(ee) supplemental label for medusahead control in Arizona, California, Colorado, Idaho, Oregon, Washington, Wyoming, and Utah. In California's Central Valley, 14 oz of *Milestone* (spot treatment rate)/acre gave ~90% control of medusahead, and 7 oz/acre gave ~60% control (Kyser et al. 2012b) (Figure 47). A split treatment of 7 oz/acre in fall followed by 7 oz/acre in winter may be an even better treatment than 14 oz in fall (DiTomaso and Kyser, unpublished data). Recent research suggests that *Milestone* applied at early flowering may stop medusahead from producing viable seed (Rinella et al. 2014). *Milestone* has not been tested for medusahead control in Great Basin sites. This treatment is most useful on sites with noxious thistles as well as medusahead.

[1] Ferrell and Sellers (2014)

Figure 47. Control with aminopyralid

A dense medusahead infestation in an untreated plot (left) contrasts with a good stand of rye grass in a plot treated with 14 oz acre^{-1} of Milestone *in fall (right). (Photo: Josh Davy)*

Chapter 8: Integrated Management

Most often a single control method doesn't achieve sustainable management of a rangeland weed such as medusahead. A successful long-term management strategy usually includes some combination of mechanical, cultural, biological, and chemical control techniques. A combination of management strategies is known as integrated management (also called integrated pest management, or IPM).

Integrated management requires the land manager to adapt to shifting conditions on the ground and, if necessary, try different control techniques. Ideally, control methods are chosen to support each other, rather than tried at random. For example, maintaining a healthy rangeland system – sometimes including revegetation – is an important part of an integrated management program for medusahead. But before revegetation can succeed, a dense medusahead infestation must be controlled using burning, herbicides, or other control techniques. The combination of medusahead control followed by revegetation is one example of integrated management.

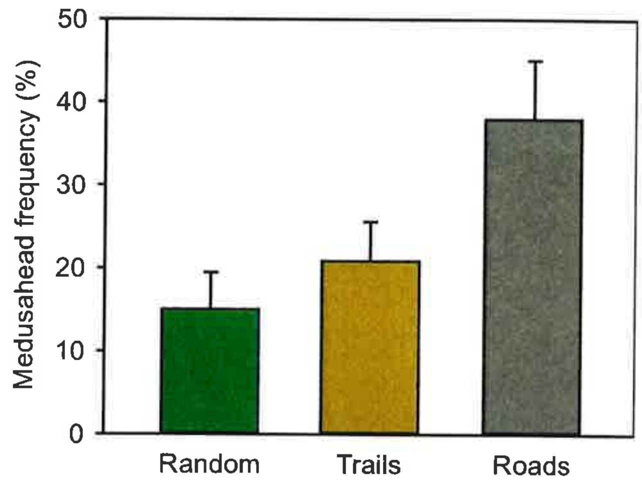

Figure 48. Occurrence in eastern Oregon
Medusahead distribution on different sites (mean values plus standard error bars). Adapted from Davies et al. (2013)

Prevention

Preventing the introduction and establishment of medusahead in new areas is far more cost-effective than attempting to eliminate an established infestation (Cal-IPC 2012). Thus prevention is an important strategy for long-term integrated management of medusahead. From a policy perspective, surveys have found that the general public is more supportive of programs to prevent invasion of new species into public lands than of programs to rehabilitate infested, degraded rangeland (Rollins and Taylor 2012).

The major elements of a prevention program are preventing introduction of medusahead seed, reducing the susceptibility of the ecosystem to medusahead establishment, establishing a program for early detection and monitoring, and developing effective education materials and activities (DiTomaso 2000).

Preventing introduction of seed

In a landscape-level survey of medusahead distribution in southeastern Oregon, Davies et al. (2013) found that infestations were concentrated along travel routes, primarily unimproved roads and secondarily trails and animal paths (Figure 48). This suggests that vehicle traffic – including cars and trucks, construction equipment, and farm machinery – is a primary source for introduction of medusahead seed, followed by movement of livestock.

The best ways to prevent introduction of medusahead seed into new areas include:

Vehicle, clothing, and livestock hygiene.

Vehicles and equipment working in medusahead-infested areas, particularly during summer months when the heads have viable seed, should be cleaned on site before moving to new, uninfested areas. Vehicles entering uninfested areas, especially agricultural, construction, and fire-fighting equipment, should be inspected and cleaned if necessary.

Field workers should check their clothing and brush off any clinging seeds before leaving infested areas and before entering clean sites. Medusahead seeds are most commonly found in shoelaces and shoe eyelets, socks, and pants cuffs.

It is probably unrealistic to ask ranchers to inspect and clean seed from their livestock. However, seed dispersal by livestock can be greatly reduced if livestock are not transported directly from infested sites to clean sites during summer (Davies 2008). If transport has to be done at this time, it is advisable to hold the animals between sites for a few days to give them a chance to shed attached seed. Sites where animals are unloaded from transport should be inspected periodically for new infestations.

(Photos: Erica Spotswood, UC Berkeley)

Control along infestation corridors.

Controlling medusahead infestations along transportation routes entering clean areas is of the highest priority (Davies et al. 2013; Johnson and Davies 2012). Not only are infestations more likely to occur along travel routes, but vehicles and animals moving along infested roads and trails can move seed into new areas.

Preventing local seed movement.

A medusahead-infested area next to a clean site poses a high risk of invasion. If possible, the infestations closest to the uninfested area should be controlled to leave more of a protective buffer.

Because most medusahead seeds drop near the plant and don't self-disperse over greater distances, vegetative buffers can help to contain infestations. In one study, the perennial grass desert wheatgrass was planted in containment "fences" 20 ft (6 m) wide around medusahead infestations. These barriers prevented about 98% of medusahead seed movement out of infested areas (Davies 2008; Davies et al. 2010). Used as exclosures, such buffers might serve to limit medusahead encroachment into ecologically sensitive sites.

Using clean materials.

When agricultural or construction materials must be introduced to a clean site, these products should be free of medusahead seed. For example, seed mixes for revegetation projects, and hay for forage, should be certified weed-free. Gravel and fill material for construction should be inspected at the source site to ensure they are weed-free, and the sites where such material is used should be inspected periodically for new infestations.

Reducing ecosystem susceptibility

One of the ways to prevent medusahead from establishing on a clean site is to maintain a strong stand of competitive vegetation. This may require grazing management or other cultural practices which favor desirable species. Soil disturbance should be avoided, as this can allow medusahead to establish. Some sites may require revegetation to fill in weak or patchy stands.

Grazing management.

As discussed previously, proper management of livestock grazing can reduce populations of medusahead. Likewise, grazing can be managed to maintain desirable vegetation.

On low-elevation rangeland, other annual grasses are very competitive with medusahead and can help to prevent it from establishing. Overgrazing of low-elevation rangeland during early spring can reduce seed production by desirable grasses, leaving fewer propagules to maintain a strong stand in the following year. Annual grassland should not be grazed hard just before or during flowering times for forage grasses.

On high-elevation rangeland, grazing too hard, especially in spring, can reduce the vigor of competitive perennial grasses. The season of use should be rotated so that perennial grasses can set seed prior to grazing at least every other year. Best grazing management for these rangelands is often a rotation system where sites are grazed during the growing season one year, after seed set the next year, and not at all (rest from grazing) in the third year.

Minimizing disturbance.

Soil disturbances such as construction projects, mechanical brush removal, grading, and so on should be conducted with caution in uninfested rangeland. If these activities take place near the edge of a clean area, adjacent to an infested site, medusahead can readily establish in the disturbed soil. If the disturbance zone is linear, as with construction of a road, powerline right-of-way, or pipeline, it may conduct a medusahead infestation into the clean site. After soil disturbance projects are finished, especially projects near or crossing the edge of a clean area, the disturbed soil should be inspected periodically for new infestations.

Revegetation.

On high desert rangeland, perennial grasses are more competitive with medusahead than are forbs or shrubs. In this environment, the best way to limit establishment and spread of medusahead is to manage for a strong stand of two or three types of bunchgrasses, and to seed in grasses if necessary (Sheley and James 2010). (See the discussion under Revegetation.)

Monitoring, early detection, and rapid response

It may not always be possible to prevent medusahead seed from arriving on a site. However, monitoring the site for new infestations, paying particular attention to those areas at highest risk of invasion, can help to detect a medusahead infestation in its early stages. At this point, medusahead can be eradicated before the plant becomes widespread, crowds out other species, and develops a soil seedbank. The previous paragraphs provide some hints on how to do this.

Concentrate on areas at highest risk of invasion.

Monitoring efforts should be concentrated in areas where medusahead seed is most likely to be introduced. The areas of highest risk include areas adjacent to roads, trails, and facilities, especially toward the edge of the clean site; livestock staging sites; recently disturbed soils, or places where gravel or other fills have been introduced; and edges of the clean site which may be adjacent to infested areas. Another priority might be areas with high scenic or ecological value.

Monitor at times of year when medusahead is easy to see.

In early spring, medusahead is hard to distinguish from other grasses. Later in the season, when medusahead begins to flower, it is easier to see. Unfortunately, by this time medusahead may already be producing viable seed. Monitoring is most effective when coupled with rapid-response tactics, e.g., pulling, hoeing, or spot-treating with glyphosate as soon as plants are found. If the seeds appear to have filled, it is advisable to remove, bag, and dispose of the plants. It is also useful to mark the site of the infestation using a GPS unit so the location can be watched closely in future.

Education

Education is a proactive and inexpensive means of preventing medusahead invasion. Workers, cooperating agencies, and recreational users of a clean site should know how to identify medusahead and should be made aware of the consequences of a medusahead infestation.

Who should be informed.

- Ranchers and other landholders on neighboring properties, and on properties which source livestock to the site
- On-site workers, including short-term workers such as fire crews, construction companies, and transportation and delivery services
- Agency personnel and recreational users, such as hunters, campers, and hikers, who may access the site

What they should know.

- The potential economic and environmental consequences of an unmanaged medusahead infestation
- How to identify medusahead in the flowering stage, and what the seeds look like
- Major risk factors and introduction routes for medusahead seed
- Basic seed hygiene for vehicles, equipment, clothing, and livestock
- How to report newly detected infestations (e.g., to the site land manager)

Developing a Management Strategy

Implementing a Strategic Plan

Medusahead can be managed by proper use of grazing, prescribed burning, mechanical removal, or herbicides. However, integrating some of these methods can provide even better control (Davies 2010; Davies and Sheley 2011; Kyser et al. 2007; Monaco et al. 2005). For example, several methods of controlling medusahead also remove medusahead thatch (i.e., burning, tillage, and sometimes mowing or grazing). Thatch removal can result in improved grazing, better efficacy of preemergence herbicides, and more successful establishment of revegetation plantings.

Table 8 (end of this chapter) gives a summary of medusahead management options.

Examples of Integrated Management Programs

Burning followed by preemergence herbicide

In a study conducted at two sites in California (Fresno and Yolo counties), medusahead management was monitored in a two-year integrated program using prescribed burning and the herbicide imazapic, either alone or in combination (Kyser et al. 2007). At each site, four different treatments were compared with untreated control plots. Treatments included two consecutive years of prescribed burning (May or June), two consecutive years of imazapic (applied in fall), burning in the first year followed by imazapic treatment in fall, or imazapic treatment in the first year followed by burning in the second year.

Medusahead cover in untreated sites averaged 45% in Fresno County and 71% in Yolo County. A single burn gave 98% control of medusahead in Fresno County and 85% in Yolo County. After a second year burn, control was better than 96% at both sites. By comparison, the combination of a late spring burn (which removed the thatch) followed by a fall imazapic treatment nearly always gave 100% control of medusahead the following year. In this study, using these combined techniques, it was possible to achieve complete control of medusahead in a single year.

Preemergence herbicide and revegetation

As discussed earlier, a vigorous stand of perennial grasses can help to prevent medusahead from establishing. Yet it is difficult to establish perennial grasses on a medusahead-infested site. This presents the land manager with a catch-22 situation. One solution is to control the infestation before seeding, using a preemergence herbicide.

Some researchers have suggested treating with imazapic and seeding with desirable species at the same time (the "single-entry" approach; Sheley et al. 2012a, 2012b) (Figure 49). However, recent comparison trials suggest that seeded species establish more successfully if seeding is delayed after treatment with imazapic. Davies et al. (2014) established plots where seeding was delayed for one year after burning and treating with imazapic, versus plots where treating

Figure 49. Treatment and seeding in a single pass

The single-entry approach shown here is an efficient method of seeding and applying herbicide simultaneously. However, seeded species show improved establishment if planted a year after imazapic application. (Photo: Brett Bingham, Eastern Oregon Agricultural Research Center, Burns, OR) and seeding were conducted at the same time. Two years after seeding, perennial grass cover was six to eight times higher in plots where seeding was delayed, compared to plots where treating and seeding were conducted at the same time (and more than 20 times higher than in plots with no treatment at all). Wilson et al. (2010) found that even a six-month delay (treating with imazapic in fall and planting in early spring) resulted in poor perennial grass establishment; these researchers likewise recommended waiting a full year.

In these studies, burning probably improved herbicide efficacy by removing litter. Thatch removal, medusahead suppression, and the release of nutrients tied up in the thatch all contributed to improved establishment of bunchgrasses.

Use of imazapic to manage medusahead can be most successful when there is a good population of established resident vegetation. This herbicide is relatively safe on established perennial grasses and sagebrush, so the presence of these plants can help to jump-start revegetation efforts. Davies and Sheley (2011) found that the combination of burning followed by imazapic resulted in improved control of medusahead and greater increases in resident perennial bunchgrasses than did burning or imazapic applied individually.

In areas without much desirable resident vegetation, it may be useful to apply glyphosate at the time of planting to control emerged weeds (Wilson et al. 2010). Glyphosate has no soil residual and will not affect newly planted seed. Though the research hasn't been done, to our knowledge, this might be a good application of the single-entry approach described above.

Mowing or grazing as part of an integrated strategy

Reed (2010) found that mowing medusahead before seed production for two years resulted in improved establishment of seeded native grasses and forbs. Like burning, mowing can both suppress medusahead and remove thatch, improving a site for reseeding. Using mowing or burning to remove medusahead thatch has also been shown to increase the effectiveness of subsequent sheep grazing (Lusk et al. 1961).

Following fall application of a preemergence herbicide to control medusahead, mowing can be used in spring to control escapes before they produce seed. Postemergence herbicides may also be useful as a follow-up treatment.

Table 8. Options for managing medusahead

This summary of options discussed in this guide will give the land manager some idea of how different techniques can be combined into a management strategy. See linked sections for more details.

Main goals	Management activity		Limitations	Timing
Prevent medusahead from producing seed	Mechanical control	Hand removal	Impractical for large infestations	Mid to late spring
		Mowing	Limited by terrain; can spark a fire; not recommended for high desert	Mid to late spring
		Tillage (disc)	Limited by terrain and rocky soil; not recommended for high desert	Spring
	Grazing management		Overgrazing or grazing too early can damage desirable forage	Mid spring
	Prescribed burning		Air quality, fire escapes, temporary forage loss; not recommended for high desert	Early summer
	Chemical control	Preemergence	Off-site movement; resistance; non-target effects. May be improved by removing thatch.	Fall
		Postemergence	Off-site movement; resistance; non-target effects	Mid to late spring
Remove medusahead thatch	Mechanical control	Mowing	Limited by terrain; can spark a fire; not recommended for high desert	Mid to late spring
		Tillage (disc)	Limited by terrain and rocky soil; not recommended for high desert	Spring
		Tillage (harrow)		Any time
	Grazing management		Overgrazing or grazing too early can damage desirable forage	Mid spring
	Prescribed burning		Air quality, fire escapes, temporary forage loss; not recommended for high desert	Early summer
Improve rangeland	Remove medusahead thatch			
	Grazing management			
	Revegetation		Can introduce nonnative species. Success is improved by removing thatch and controlling medusahead.	Fall or spring
Prevent medusahead reinvasion	Improve rangeland		See above. Also, minimize soil disturbance in areas adjacent to infestations	
	Prevent seed introduction		Make sure human activities, livestock, and imported materials are free of seed	Any time
	Monitoring		Watch site for medusahead escapes, especially along roads and trails	Late spring
	Education		Inform site workers and visitors about medusahead	Any time

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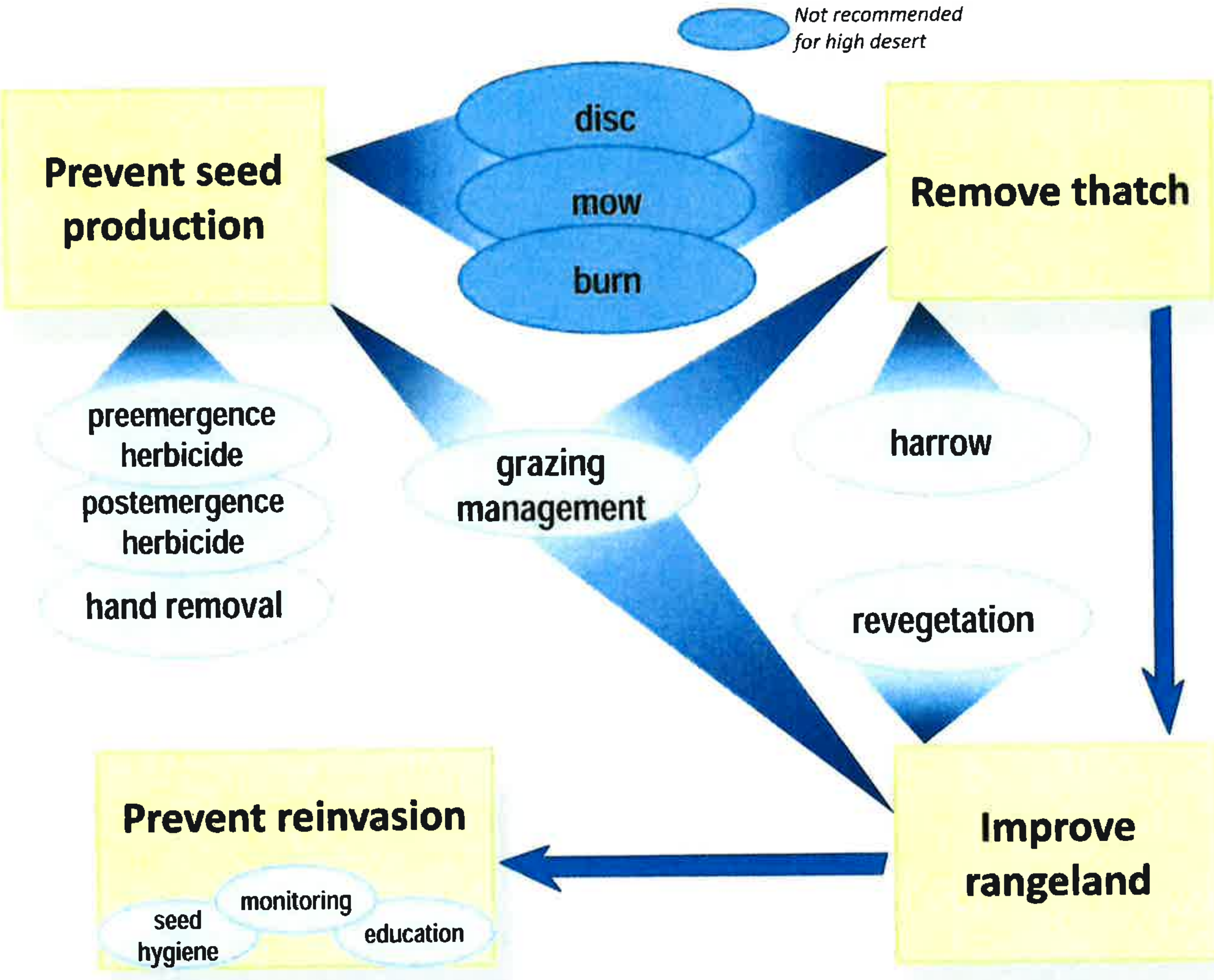

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