Report of Findings

Galbreath Field Station

Sonoma State University

RIM Architects

June 28, 2011

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Tab 1 :: Introduction

PROJECT UNDERSTANDING

The Galbreath Wildlands Preserve is located in Mendocino County, approximately 17 miles inland of the California Coast. This 3,670 acre property was donated to Sonoma State University (SSU) in October 2004 in memory of Fred Burckhalter Galbreath with the wish that the land be protected in perpetuity and would promote environmental education and research and maintain the stewardship of the diverse landscape.

Approximately seven (7) acres of this land has been determined by SSU as an advantageous site amongst the topographically diverse landscape for development of a Field Station due to its gentle terrain, potential vistas and it is located 1.5 miles from the main entrance along an existing dirt road. The site also includes a north gate entrance, which is not intended to be utilized to access the Field Station site.

The Field Station development would involve overnight facilities (e.g., kitchen, dining, cabins, bathrooms) to encourage interaction and build relationships amongst those that visit the facility. Supporting facilities may include a common building with meeting and laboratory spaces, a shop facility and an adjacent parking area.

Additionally, three to four potential sites had been defined for a future Astronomical Observatory, which would be accessible by the existing gravel road and are also near the south entry gate. The potential site has been finalized into one prime location for the assessment. The observatory will require routine maintenance and polishing of the lens at certain intervals.

The Galbreath Wildlands Preserve is one of two preserves administered by SSU Field Stations & Nature Preserves for the purposes of promoting education, research and outreach in California's North Coast Range. To support the activities of a diverse interdisciplinary community of learners (researchers, students, community members) at the site, the Galbreath property needs accessible facilities that allow short and long-term stays for classes, research teams, workshops, and meetings. SSU's vision for the Galbreath field station is a suite of facilities that encourages study in a wide diversity of disciplines, enhances the surrounding natural environments, meets minimum LEED Silver standards, employs off the grid utilities, incorporates smart building technologies, and generates innovative approaches to enhance human and human-environment interactions.

Access to the field station and observatory sites is a dirt road that crosses three bridges, some sections of which require 4-wheel drive due to steep terrain and wet weather. A detailed study identifying treatments to minimize erosion from the road has been completed by SSU and its collaborators (Galbreath Preserve Road Drainage Improvements, Pacific Watershed Associates Report No. 07076701).

There is currently $700,000 allocated for this first phase of the project. It is desirable to allocate a portion of this initial funding to support the physical construction of a portion/element of the development to act is the initial catalyst for future continued development of the project.

The Galbreath Field Station Conceptual Master Plan Development project is an effort comprised of many parties from the University and the Design Team. These parties have pursued investigation with outside parties that will influence the design with constraints and development parameters. The key individuals from these parties including their responsibilities are outlined as follows:

Sonoma State University – SSU:

Claudia Luke	Field Station Director	Key Stakeholder in the development of this Field Station and future Field Station Manager
Christopher Dinno	SSU Campus Architect	SSU Stakeholder providing input and direction for design of the facilities
Carol Ingerman	SSU Contract Specialist	Responsible for ensuring the Design Team meets the requirements of the Agreement
Nora Hild	SSU Project Manager	SSU Project Manager overseeing the Universities commitments to meeting goals for the project
Dr. Adrian Praetzellis	Director, Anthropological Studies Center	Cultural Resources director, providing research for cultural impacts for development of Field Station
Dr. Scott Severson	Director, School of Science and Technology	Director providing input for development of the Observatory

RIM Architects Design Team:

Michelle Jones	Managing Principal (CA) :: PIC, RIM Architects	Principal in Charge overseeing Scope of Work and ensuring the Design Team delivers the project according to the terms of the Agreement
James Dougherty	Managing Principal (AK) :: Design Architect, RIM Architects	RIM's Design Architect responsible for setting the goals, objectives and vision for the Master Plan Development
Steve Kushner	Project Manager, RIM Architects	RIM's Project Manager, assisting Michelle with scheduling, investigation and delivery of the scope of the project
Peter Briggs	Landscape Architect, Corvus Design	Site and Landscape designer, responsible for collaborating with James to set the goals, objectives and vision for the Master Plan Development
Dan Sicular	Senior Managing Associate, ESA	Responsible for coordinating the ESA team for the Environmental assessment for the Master Plan Development
Richard Ingram	Vice President, Brelje and Race :: Civil Engineering	Responsible for coordinating the Civil and Geotechnical investigation for the roadway access and site development improvements
John McKernan	Vice President, BCCI Construction :: Construction Costing and Constructability	Responsible for providing feedback and input for remote construction factors, project phasing and cost estimating

Additional parties have become involved during this initial Investigation Phase and their input and efforts are documented further within this report.

GOALS AND OBJECTIVES

The intent of pre-charette investigations is to develop a higher level of understanding about the project. This information is the foundation for the charette (as well as any typical master plan process) in that it helps to identify as much information as possible that is relevant to the project. The goal is to have a good understanding of knowns and identify unknowns, and to identify opportunities and constraints. The goal is to acquire a broad range of relevant information with the aim of reducing the possibility of unforeseen consequences.

This information typically includes:

1. Understanding desired programming for the development (i.e. number of researchers to be housed),
2. Understanding level of services and comfort (i.e. showers),
3. General code and functional requirements (i.e. zoning conditions and accessibility requirements), and those that are specific to this site (i.e. fire access requirements),
4. Site biophysical characteristics (i.e. solar exposure, soil composition, plant and wildlife mapping),
5. Services and utilities (i.e. power sources, availability, options, and local sensitivities),
6. Local Conditioning (i.e. access and availability to roads, stores, equipment) and their impact on construction.

One reason for collecting this information is to use the requirements to create realistic measurements for creative ideas. Another reason for identifying the above information is to determine information to be factual NEEDs for the project, or subjective information to be confirmed as a NEED or WANT. Items that are considered to be WANT require a higher level of evaluation and decision. Creative ideas, evaluation of WANTs and decisions of NEEDs are the purpose of the Design Charette, the next phase of this project.

The reason for a charette for this project has a number of facets:

1. Information. Many of the requirements for this development will be dictated by code or typical design practices. Briefly sharing this information can help to focus discussion to where it is of the highest use.
2. Validation. Examining proposed programming is good to assess the validity of assumptions.

3. Unique needs. Future users may have needs that are unique to their area of research. Without their input, it is difficult to anticipate these and provide such facilities or the ability to incorporate them smoothly in the future.

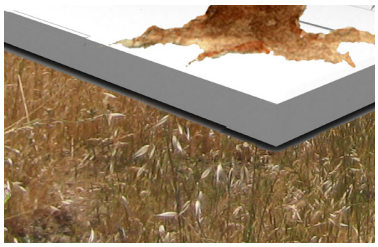
4. Brainstorming. Gathering of information from a number individuals of various backgrounds provides a higher possibility that the right solution will be available for the right problem.

5. Prioritization. Assessment of the products that arise from brainstorming in order to define specific achievable goals and objectives.

The main intent of any charette is to brainstorm in an organized fashion. The goal is to open the process up to 'blue sky thinking' where all ideas are worthy of consideration. This allows otherwise unexpected and good ideas to be considered, rather than just moving pre-supposed ideas forward. The Charette is a good opportunity to blend the physical of the site analysis with the metaphysical of how the site feels and means. The other intent of the charette is to organize and prioritize the ideas and concepts that are introduced. The desire is that there is an orderly movement from 'free thinking' to a grounded and useful product for the next stages of the project.

At the conclusion of the investigations stage and charette, we will have a higher level of understanding how a prescribed development type (field station) needs to be tailored to the specific needs of Sonoma State University and those individuals who will use the site. The information gained and developed during these stages will then be refined and integrated into a Master Plan for the site. This Master Plan will service two main functions: Prioritizing development activities that will occur in the short term, and providing a clear development pathway for the future. Master Plans provide for orderly and logical growth for a site by being prescriptive where possible (i.e. location for future buildings), but also providing performance-based guidance for unexpected items. The Master Plan will be a combination of maps and exhibits that describe spatial organization, and narrative that provides additional information and guidance.

Tab 2 :: Site Evaluation



ROAD ANALYSIS & CIVIL INVESTIGATION

Road Analysis

Previous Analysis of Roads

The roads at the GWP were previously reviewed and analyzed by Pacific Watershed Associates (PWA) for the Mendocino County Resource Conservation District (MCRCD) and SSU. Findings were included in a March 2007 report. The analysis was limited to a review of existing road conditions and recommendations were aimed specifically at preventing erosion and sediment transport. The PWA report identified 24 locations where some form of remedial treatment was recommended on the sections of the approximately 3.5 miles of existing roads that are of concern for access to the Field Station and the Observatory. Remedies for the areas of erosion concern included specific recommendations such as bridge replacement over Camp Creek, culvert installation to carry the 100 year storm event, installation of rolling dips in the roadways to direct drainage, addition of ditch relief culverts, remediation of landslides, cleaning ditches, and adding rock to road surfaces.

MCRCD Proposed Work

The EPA has approved a grant to fund GWR road improvements that are aimed at carrying out the PWA report's recommendations. The project is scheduled to begin design at the start of calendar year 2012. It is the intent of SSU to coordinate the efforts of the MCRCD with the development of access improvements for the Field Station and the Observatory. Coordination meetings are planned to help assure that common goals for road improvement are achieved.

General Road Standards, Design Criteria and Regulations

The desired vehicular access criteria as indicated by SSU for the GWP is 2 wheel drive access to the Field Station and Observatory sites. Provision of emergency vehicle access is required to allow development of the Field Station buildings and Observatory. Consideration of construction access is also necessary. The construction of the Field Station and/or Observatory will require a use permit and building permits, administered by Mendocino County Planning and Building departments. Planning and Building departments will require a sign-off for access improvements from CAL Fire to insure the availability of access for of emergency vehicles.

General Fire Safe Regulations as they relate to the access road/driveway standards are promulgated in Title 14, Code of California Regulations: Division 1.5, Chapter 7, Subchapter 2, Articles 1-5. Articles 1-2 are pertinent to GWP and are summarized as follows:

Article 1

- The inspection authority may be either CAL Fire or the local jurisdiction (County).
- Provides for request and approval of exceptions (request in writing to the inspection authority listing applicable code section, material facts supporting exemption request and listing the proposed mitigation and providing a map of the proposed change.

Article 2 – Road Standards (emergency access)

- Two 9 ft traffic lanes(18 ft)
- Minimum 40,000 pound load capacity
- Maximum grade of 16%
- Minimum inside curve radius of 50 feet
- Turnarounds – 40 ft min radius – Hammer head T may apply
- Turn outs spaced at 400 feet (min 10 ft wide x 30 ft long with 25 ft tapers each end)
- 10 ft min width for one way roads
- Driveway Standards
- 10 ft min width
- 15 ft vertical clearance
- Maximum grade of 16%
- Minimum 50 ft inside turn radius
- Turnaround at building is required

Mendocino County Road Standards include grade limits (Standards Tab C.3.M) at 16% but provides for the County DOT Director the authority to approve grades in excess of 16% if surfacing and additional features such as turnouts, etc. consistent with acceptable practice such as Cal Fire fire safe standards. The process for allowing grades exceeding 16% requires the request for exception (Standards Tab H – Exception Procedures). The County Standard additionally requires a 0.7 traction coefficient for 50 ft

minimum radius curves without super elevation (Standards Tab C.3.O). Compliance with the traction coefficient may be inconsistent with recommendations provided for in the 2007 PWA report. The Mendocino standards include a "Low Impact to Hydrology Guidelines Alternate Design Standards." This standard appears to be the standard followed in the recommendations in the report by PWA (Standards Tab Ca) and should be a key consideration in the development of the GWP roads.

Access Road Field Review, Civil and Geotechnical Analysis; Upgrades

Field reviews of existing conditions were conducted on two separate days. GWP Director Claudia Luke was present both days. Cal Fire representative Shawn Zimmermaker drove the access roads and discussed Cal Fire access requirements and strategies during one of the field reviews.

For the purposes of observation and analysis, the access roads have been broken into four sections:

1. **SECTION 1** - Site entry to the location where road ascends up away from Camp Creek – approximately the first 0.6 miles of roadway
2. **SECTION 2** - From mile 0.6 to the proposed Field Station at approximately mile 1.8
3. **SECTION 3** – From the proposed Field Station (mile 1.8) to the location where the access to the Observatory leaves the main road (approximate mile 3.5)
4. **SECTION 4** – From mile 3.5 to the Observatory (approximate mile 3.9)

Figures 1 - 4 show Sections 1 - 4 of the roadway. The approximate road profiles are also shown on the figures. See Tab 6 :: Exhibits

Road Section I

Road Section I is relatively flat from the beginning of the road at the site entry and runs adjacent to Camp Creek, crossing with makeshift bridges with abutments in the adjacent stream terraces at three locations. Maximum slopes of Section I occur near the site entry and are relatively short and within County standards. This section of road will require replacement of the three bridges with wider, longer and possibly higher elevation spans to facilitate all-season access. The graded sections of this road could possibly require raising to avoid flooding during large storms. The flooding potential of this section should be reviewed prior to development. The new bridge abutment foundations would require evaluation with further geotechnical exploration. Foundation depths would likely be adequate if they penetrate some thickness (to be determined) of the terrace deposits. Existing road widths vary and but would generally be categorized as single lane. There are ample opportunities to create turnouts in this section and installation would be recommended at spacing's not exceeding 400 feet at locations were site lines between turnouts were generally not obstructed. Road surfaces are in good condition in this section considering the reported low frequency of grading and maintenance. For

repair and upgrade remedial recommendations found in the PWA report should be followed and the road should be maintained with regular grading and cleaning of ditches and culverts.

Road Section II

Road Section II turns away and up from Camp Creek generally winding its way up a steeply ascending ridgeline toward the proposed location of the Field Station. Average road slopes for the 0.75 mile mid-section of the 1.2 mile long Section II are approximately 18 percent. Road widths vary but would generally be categorized as single lane, however much of the road within the segment is at least 16 feet wide. The area of use of the current road is often less than the area that was graded initially for the road. If these areas were cleared of vegetation and debris the roads could often be widened to be classified as two lane. There are adequate opportunities to create turnouts in this section and installation would be recommended at spacing's not exceeding 400 feet in areas where the road could not maintain a width of 18 feet – the minimum to meet the two lane standard. Site lines between proposed turnouts will be obstructed in some locations and not in others. Road surfaces are generally in good condition in this section considering the low frequency of maintenance.

There are two general and significantly different options for addressing the likely access road improvement requirements in Section II. The options would require different approaches with respect to eventual environmental review and strategies to obtain a project Use Permit from Mendocino County.

The options are as follows:

Option 1 - Utilize the existing alignment, with minor improvements and general maintenance, including EPA contract improvements.

Option 2 - Realign significant sections of the existing roadway to comply with road standards without variances.

Option 1

Existing road alignments and slopes would be followed. A maintenance program would be developed that widened the road by clearing those areas not now in use, utilizing those road areas that have previously been established within the roadway prism. Several areas immediately adjacent to the current path of the road present significant opportunities and with minimal effort could be re-established as turnouts and lengthy widened sections with little more than weed and brush removal. Repair and remedial recommendations found in the PWA report should be followed and the road should be maintained with regular grading and cleaning of ditches and culverts.

Feedback from CAL Fire has indicated that Option #1 would be likely acceptable for their interests, which are mainly to facilitate access for their emergency vehicles during structure or wild fires. CAL Fire indicates proposals for road improvements in circumstance that would require an exception to the regulations regarding slope limitations should consider the addition of an ample number of turnouts and include a number of practically placed turn-arounds that would allow their vehicles several options to turn around when accessing and leaving the site. Proposal of onsite water storage for fire suppression at the development locations would strongly support an application for an exception to the road regulations. Option #1 is also the least expensive because the existing road alignment is basically in good condition in light of the infrequent maintenance it receives.

Much of Section II has an average grade exceeding the maximum grade prescribed for fire access without paving. Although Cal Fire has expressed that this portion of the road may be considered suitable for its purposes, it is not clear how Mendocino County would treat the existing alignment with the minor modifications as proposed in Option 1. For Option 1 to be successful, an initial strategy of robust maintenance, widening and upgrade of the roadway, replacement of bridges, elimination of erosion by bringing the existing roadways in compliance with the 2007 PWA report prior to further site development would be recommended. These actions would provide the GWR the best opportunity for gaining favorable Use Permit conditions when applications and site inspections are made with the County in advance of site development. The road improvements should be consistent with the Low Impact Alternative Design Standards adopted by Mendocino County.

Option 2

The goal of this approach would be to modify the road so that it strictly meets known Cal Fire and Mendocino County road standards without variances.

Since the average grade for the over three quarter mile mid section of the existing Section II road is about 18%, the prospect of developing an under 16% grade profile over the entire alignment would be very challenging. Establishing a compliant slope by modifying sections of the road would not be possible without creating major new sections of road that do not follow the current alignment. Major additional switchbacks would be required to lengthen the road and may not be possible at all without the development of very expensive retaining walls because of the very steep cross slopes that drop off on either side of the ridgeline.

There are several problems associated with constructing major new sections of road in this area. The vicinity of the site is underlain by the Cretaceous Coastal Franciscan formation, which is comprised predominately of sandstones and claystones which have been extensively fractured and locally sheared. The Franciscan formation is the basement rock for the region. This rock material is locally weak and friable. Active landslides and inactive landslide debris which can be reactivated by grading are present. There are boggy sections and ephemeral seeps present. The site lies within the seismically active

Northern Coastal Region of California. Low magnitude earthquakes are common in the region. In general, new road construction on sloping ground with potential instability is expensive, either initially if all geologic hazards are suitably addressed with re-routing, retaining walls, sub-drainage systems and other geotechnical engineering construction or later, by high maintenance costs and loss of use during storm or other events.

Option 2 would require a very detailed engineering design to capture all of the potential infrastructure costs associated with the development of new roadway sections that do not follow the current road alignment. Extensive geotechnical analysis would be required.

Road Section III

This section, from the Field Station site to the turnoff to the Observatory, is similar to Road Section II in that it contains steep sections but is generally narrower. It is underlain by the same geologic formation as Section II, and it traverses north facing slopes with heavier vegetation and soil cover and some wet sections. Issues for improvement are similar to Section II except that it may be possible to categorize use of the road and types of vehicles accommodated as less stringent than for the Sections I and II, which is the primary site access. General options and strategies for road improvement would be the same as for Section II.

Within Section II an alternative route exists that would essentially traverse the hillside leaving the existing road about 1500 feet north of the Field Station site, following a very gentle grade downhill traversing undeveloped areas to the beginning of the Road Section IV. This alternative alignment would require major vegetation and tree removal, grading of an entirely new road with an approximate length of 3000 feet on a steep side hill. The new road alignment would also require traversing across deep drainage crossings.

Road Section IV

The existing road to the currently chosen Observatory site crosses some active and inactive landslides in the initial 900 foot section and then essentially dwindles to fire break running over the ridge topography at very steep grades (20%, more in some areas) for the remaining 1200 feet to the Observatory site. The road is not developed for travel akin to the other roads previously described and not mentioned in the evaluation conducted by PWA in 2007.

Proposed road improvements would run the full length of the existing access. The road would be proposed as a minimum width (10 feet) single lane access with turnouts every 400 feet. The single lane width would minimize the grading required. The steep sections would require paving. Some deep cuts and sliver fills would improve but not completely reduce existing grades to those meeting County Standards. Re-routing the alignment could produce a more gently-graded alignment but produce high side hill cuts that would be visible from long distances and affect much of the well established

large trees along the alignment. According to Cal Fire, chip seal over compacted base rock would be considered paving. The road improvements over this section of roadway would be more costly per foot than in other areas of the site due to site constraints and the poor development of the existing roadway.

Alternatively, the Observatory could be developed on a site in the saddle immediately adjacent to the Section III to Section IV turnoff. This short section of road could be developed easily and at low cost.

Construction Access

Issues of construction access include delivery of materials and equipment during the construction of the Field Station and Observatory. The proposed Observatory would require the delivery of an 8 foot x 20 foot standard shipping container that would house the shell components for the outside of the Observatory. Improved roads to the standards suggested would likely accommodate truck delivery of the container over Sections I, II and III. Section IV would exhibit steep grades, a narrow width and a poor truck turn-around at the Observatory site. Alternative transport of the Observatory components should be considered for Section IV and may include transport by skidding or a special trailer drawn by a dozer. Consideration should also be made for transport by a large cargo helicopter, thus eliminating the need to truck the container off of the main highway.

The trucking of concrete to the site should also be considered. Bridges should be designed to meet previously delineated Mendocino County Standards for weight. Road slopes are also a concern to concrete delivery trucks. Trucks will likely have to consider limiting the capacity of their loads because the steepness of the road slopes may cause the truck to overflow concrete out the back of the mixer during delivery.

Other building materials can usually be accommodated by breaking loads down when arriving at the entry of the site to smaller divisions and hauling them to the construction sites in appropriately sized delivery vehicles.

Local Utilities (Water Supply and Wastewater Disposal)

Field work regarding septic suitability was completed onsite June 24, 2011.

GEOTECHNICAL INVESTIGATION

Site Area and Boring Location Description

A key map and a map of the location of borings and test pits (Figures 5 & 6) are attached to this report. These figures were prepared by Brelje & Race (B&R).

Topography

The site is in the northern portion of the Coastal Ranges geomorphic province of California and is characterized by moderate to steeply sloping ridges separated by deeply dissected drainages in a generally northwest trending structural orientation. Locally, rainfall on the site flows as sheet flow off the ridges, collecting in minor drainages which are tributary to Elkhorn Creek, which meanders in a northerly direction to Dry Creek, which is adjacent to Highway 128. Elevations at the site range from just under 1000' to about 1900' above sea level at the proposed Field Station site. Pardaloe Peak, at elevation 2470' above sea level is about a mile from the proposed Field Station site to the northwest.

Geologic Setting and Subsurface Conditions

Geologic Setting

Soils

Soils on the site are weathering products of the bedrock that underlies the site. At the time of the fieldwork, the site was covered with a thin layer of loose, dry to moist soil with higher organic content under trees than in exposed areas. The soil is described by the US Department of Agriculture-Soil Conservation Service Map as the Casabonne-Holohan-Wohly soils series. The soil consisted of low plasticity moist reddish brown sandy clay. As it grades to bedrock with depth, the structure of the underlying rock becomes increasingly evident.

In the vicinity of Elkhorn Creek, there are local terrace deposits consisting of sands and gravels that were derived from colluvial- and alluvial-sourced boulders, cobbles, sand, gravel and minor clays deposited by Elkhorn Creek. Some of the boulders and cobbles include metamorphic rocks of unknown age, including schist and limestone, which are present in the vicinity of the site.

Bedrock

The site is underlain by the Upper Cretaceous/Lower Tertiary Coastal Franciscan formation, comprised predominately of sandstones and claystones which have been extensively fractured, sheared and weathered near the ground surface. The Franciscan formation is the basement rock for the region. The rock is exposed extensively in road cuts leading to the Field Station site and locally to the Observatory site.

This rock material is locally weak and friable. Active landslides and inactive landslide debris which can be reactivated by grading are present. There are boggy sections and ephemeral seeps present. The site lies within the seismically active Northern Coastal Region of California. Low to moderate seismic shaking is common in the region.

Results of Geologic Reconnaissance

The road to the field station (Sections I and II from Road Analysis Section of "Draft Report of Findings, Galbreath Field Station, Sonoma State University, by RIM Architects, June 20, 2011") is in good condition for the level of maintenance it receives, which is believed to consist of minor care every few years. We understand that the road was constructed less than 10 years ago. Three bridges need to be replaced. The terrace deposits adjacent to the creek should provide adequate foundation for new bridges if specific geotechnical studies inform the design. There are some marshy areas next to and beneath the road locally and it crosses some younger and older landslides, but in general rock is exposed over most of the length and the rock appears stable and fairly durable. The road is outsloped over much of its length and appears to handle sheet flow drainage well, with a minimum of drainage ditches and culverts. The graded surface surrounding the road is much wider than the current vehicle track over much of its length. This could be easily developed into turnouts and two lane sections that could make the horizontal curvature and opportunity for passing oncoming traffic much better than it is currently.

The Field Station site is fairly gently sloping and is underlain by bedrock with an approximately 2-4' deep soil profile weathered from the underlying rock. There is surface water present in the form of two ponds just west of the site. The orientation of these natural depressions and the general structural geology of the area indicates a possible fault trace through this area. It is unknown the direction and depth of the water resource that discharges into the southern pond, however, a fault- or fracture-controlled subsurface source may be the cause.

The road from the Field Station to the turnoff to the Observatory site (Section III) is less developed and generally more narrow than Sections I and II. It is initially gently sloped and then turns down a long steep section on a north facing slope and has a short wet, clayey section. It then traverses additional wet sections along a relatively gentle slope and then rises along mostly firm bedrock to the turnoff to the Observatory. In general, the this road could be improved by locally addressing the wet sections (clay removal, installation of subdrainage, replacement with a gravel road base). As long as the road would not need to be widened substantially, improvements would be relatively minor.

The proposed road to the Observatory site crosses landslide deposits in the first few hundred feet and then runs along an undulating ridge with steep up and down sections to the Observatory site. For the developed road, maintenance would be higher over the landslide section of the road, but probably manageable. The rest of the road is on fairly stable appearing rock which should behave well in cut

sections. However, the extent of cut necessary to develop a road with reasonable grades could be very high. The alternative Observatory site, adjacent to the turnoff from Section III would avoid all the potential problems (instability, extensive grading) posed by the currently proposed Observatory site.

Rock for construction is exposed along much of the road, at the Field Station and the Observatory site. Most construction activities would probably involve cuts rather than fills. As a result there is a substantial amount of rock potentially available for road sub-base and other uses at the site.

Results of Test Pits and Percolation Holes

The following conditions were observed in the test pits and percolation hole. Locations are indicated on Figure 2.

Test Pit #1

Depth	USCS Classification	Description
0-½‘	CL	Topsoil, light brown sandy clay, soft, dry.
½’- 4’	CL	Reddish brown sandy clay, soft, moist, remnant rock structure evident.
4’- 8’	Rock (TKf)	Reddish brown sandstone with bands of claystone, laminated (fissile), moderately soft, moist.

Test Pit #2

Depth	USCS Classification	Description
0-2½’	CL	Topsoil, reddish brown sandy clay, soft, moist, rootlets.
2½’ - 4’	CL	Reddish brown sandy clay, soft, moist, remnant rock structure evident.
4’- 8’	Rock (TKf)	Reddish brown sandstone with bands of claystone, laminated (fissile), moderately soft, moist.

Test Pit #3

Depth	USCS Classification	Description
0-½’	CL	Topsoil, reddish brown sandy clay, soft, moist, roots to 2” dia.
½’- 4’	CL	Reddish brown sandy clay, soft, moist, roots to 2” dia.
4’- 6’	Rock (TKf)	Reddish brown sandstone with bands of claystone, laminated (fissile), moderately soft, moist.

Test Pit #4

Depth	USCS Classification	Description
0 - ½'	CL	Topsoil, reddish brown sandy clay, soft, moist.
½'- 4'	CL	Reddish brown sandy clay, soft, moist, roots to 2" dia.
4'- 8'	Rock (TKf)	Reddish brown sandstone with bands of claystone, laminated (fissile), moderately soft, moist.

Test Pit #5

Depth	USCS Classification	Description
0- ½'	CL	Topsoil, reddish brown sandy clay, soft, moist, with milky quartz float fragments.
½'- 8'	CL	Reddish brown sandy clay, soft, moist, roots to 2"dia. Color change at 4' to orange-brown. Some remnant rock structure observable between 7-8' depth.

Test Pit #6

Depth	USCS Classification	Description
0-½'	CL	Topsoil, brown sandy clay, soft, moist, with milky quartz float fragments.
½'-4'	CL	Reddish brown sandy clay, soft, moist. Soft to 3 ½', medium stiff below.
4'- 8'	Rock (TKf)	Reddish brown (with orange and yellow mottling) sandstone with bands of claystone, laminated (fissile), moderately soft, moist. Deeply weathered, behaves as stiff clay.

Percolation Test Holes

Two percolation test holes were attempted:

The first was drilled near the eventual site of Test Pit #1 prior to attempting any of the test pit excavations. The auger encountered refusal at approximately 5' depth, at which it was evident that it had drilled several inches into bedrock and then could not advance. The hole was not completed with pipe and gravel.

The second percolation hole was installed downslope from Test Pit #4 by first excavating an approximately 3' deep pit with the backhoe and then drilling an additional 2' with the auger. A 3" perforated pipe was set into the 2' hole and the annulus was backfilled with pea gravel. The hole was repeatedly filled with water for approximately the next two hours. The rate of infiltration over the two hours continued to decline but did not stabilize, indicating that insufficient time was available for pre-soak (which sometimes takes one or two days for clayey soils). A 4" diameter standpipe was slipped over the 3" diameter percolation test pipe and then the backhoe excavation was backfilled to ground surface, making the percolation hole available for future testing.

Preliminary Conclusions and Recommendations

Results of the investigation suggest the following conclusions:

1. Road Section I can be improved with minor grading and replacement of the three bridges.
2. Road Section II is in good condition mainly because it is mostly constructed in cut bedrock. The areas that cross wet spots, older and younger landslides appear to be manageable.
3. Re-routing Road Section II to improve road grade to less than 16% would require major construction over potentially unstable ground. Both construction and maintenance would be more expensive, particularly compared to slightly modifying and maintaining the existing road.
4. The area proposed for the Field Station is gently sloping and underlain by low plasticity sandy clay soils that grade into bedrock.
    a. Spread footing or drilled pier foundations that meet UBC and/or Mendocino County standards for strength, wind and earthquake resistance should be easily achieved. We suggest using drilled piers for building foundations because the depth to firm rock is fairly shallow and it is likely that less concrete would be required, which may be a significant cost issue for construction at the site.

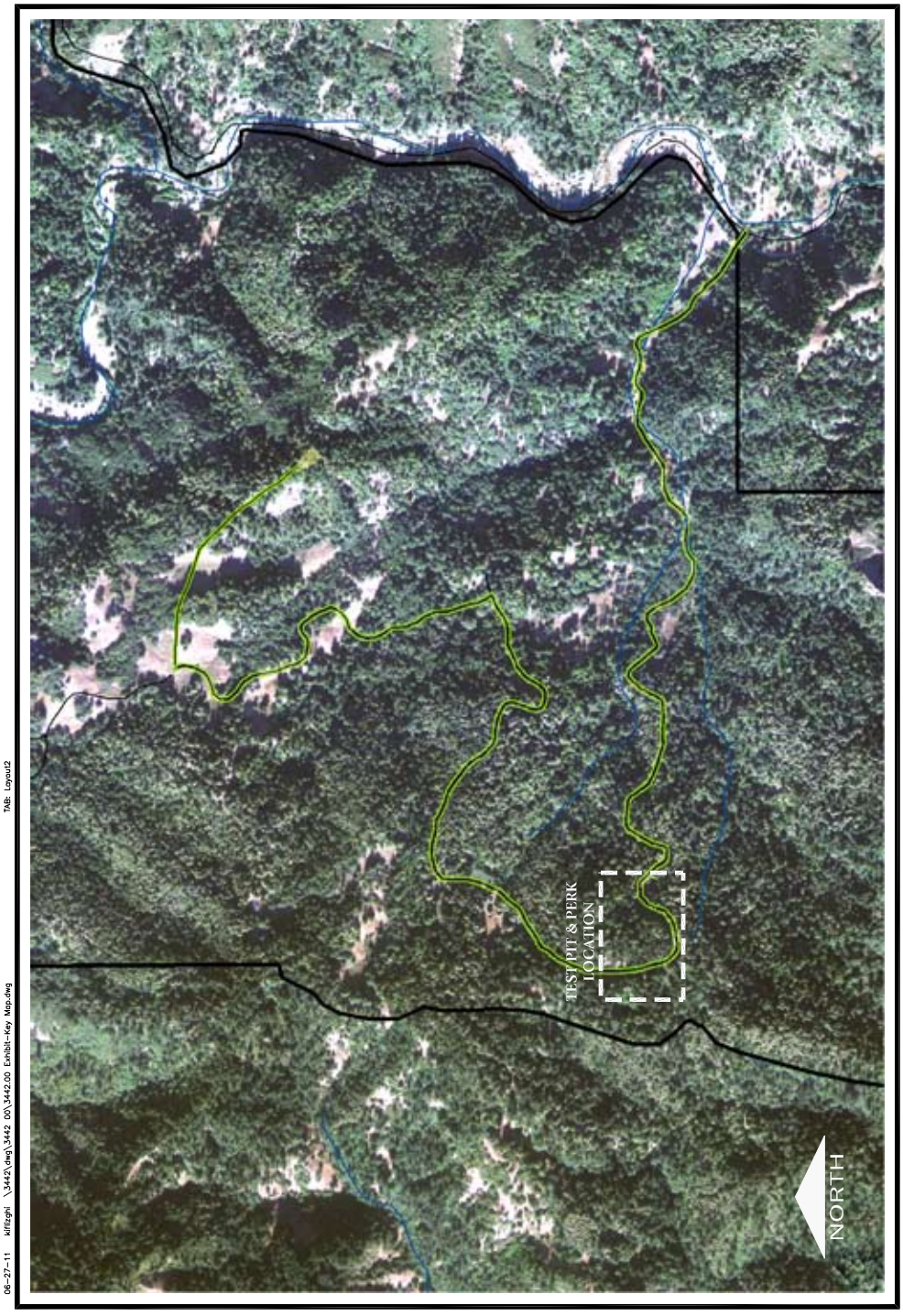
b. A septic system with conventional leach field is not likely to be approved or work well at the site if substantial numbers of visitors are planned. The presence of clayey soils and shallow bedrock are undersirable factors for a conventional leach field system. However, additional percolation testing should be performed before reaching a final conclusion.

5. Road Section III could be improved with local removal of wet clay soils and replacement with subdrainage and gravel surfacing. However, if this section requires widening or slope modification, substantially more effort and expense would be required.

6. Road Section IV can be constructed, although it will require crossing unstable areas in the initial section and making substantial cuts in the final several hundred feet to the Observatory site. The alternative site next to the turnoff from Road Section III would require far less expense in comparison.

7. The proposed Observatory site is located on bedrock that can be cut to develop sufficient room for the facility. Due to steep adjacent slopes, it is suggested this entire portion of the development be founded in cut. Bedrock is also present at the alternative site next to the turnoff rom Road Section III. Cuts and fills are both possible at this site.

8. Groundwater within the sandstone, shale and claystone bedrock is believed to be almost entirely within fracture, shear and or deeply weathered zones, a condition typical of Franciscan formation rocks. Because of the random nature of fracturing and shearing in the sandstone at the site, the location of groundwater is difficult to determine. The presence of the southerly pond and suggested fault structure west of the Field Station site is encouraging as a possible indicator of a subsurface water source. However, at the level of this investigation, it is not possible to determine a drilling location around the field station that would have substantially more potential for success than any other.



GALBREATH WILDLANDS PRESERVE
FILED STATION- SITE PLAN

KEY MAP - TEST PIT & PERK LOCATION

Brelje & Race
CONSULTING CIVIL ENGINEERS

FIGURE 5

GALBREATH WILDLANDS PRESERVE
FIELD STATION- SITE PLAN

TEST PITS & PERC HOLES

JULY 2011

Brelje & Race

FIGURE 6

BIOLOGICAL INVESTIGATION

The following outline summarizes initial site investigation efforts by ESA

Peter Hudson, ESA's staff geologist, and Dan Sicular, Sr. Associate at ESA, spent the afternoon of Thursday, June 2 at the Galbreath preserve. The purpose of the visit was (per scope of work), to observe and record, in notes and photographs, existing conditions in the planned development areas and along the access road alignment, in order to identify potential environmental constraints and sensitivities, including but not limited to hydrology, noise, traffic, and visual impacts.

They drove the access road from the gate to the intersection with the road to the proposed Observatory site, walked out to the Observatory site, then returned to the proposed Field Station site and walked most of what was considered areas with slopes < 7% on the east side of the road, and also walked out to one of the ponds on the west side. Because the sites are not clearly flagged they could not tell the exact boundaries of either site.

Briefly, the main observations of the Observatory site include the following:

Portions of the existing road (more of a jeep trail) will need considerable improvement and likely realignment in order to provide adequate access for construction vehicles and year-round access to the site once the observatory is built. This would likely involve substantial grading and vegetation removal, which raises concerns for biological resources and erosion/sedimentation issues. While they do not know the likely footprint of the observatory buildings they noted that there is very limited level area at the building site, and earth movement and vegetation removal may be necessary to provide an adequate building pad. They noted evidence of slope movement, particularly on the very steep slopes to the N and NE below the site. Instability could be exacerbated by grading and tree removal, perhaps to the extent of creating a slide hazard that could jeopardize the integrity of the built facilities; a geotechnical report should examine this possibility. Also noted that the site is a promontory, and is visible for miles from locations to the north, south, and east. Vegetation removal and grading may be highly visible from some locations. Minimizing grading and tree topping, rather than tree removal, should be considered if possible, to mitigate both slope stability and visual effects.

The main observations of the Field Station site include the following:

The site appears to be a relatively even-age, Douglas-fir dominated site that may have been planted, and appears to have been thinned previously for timber production. They did not see any defined stream channels or areas of slope instability within the site, so drainage, erosion, and slope stability issues appear to be minor. Furthermore, site development is not likely to cause a substantial visual

change for anyone off of the property, assuming some of the existing trees are retained. Site access is good and can be improved easily. Our impression of the one pond that we walked to is that it is a man-made feature that has naturalized, but that it likely has value as wildlife habitat.

Our main observations of the access road include the following:

The road is very narrow, and will likely have to be widened to allow vehicles to pass one another. We suggest site-to-site turnouts, rather than widening the entire length of the road, to minimize the area of new disturbance. Road drainage is poor in locations. The existing road assessment recommends culvert and bridge replacement, outsloping, and installing drainage features such as rolling dips, which should improve road drainage and flood conveyance. There are several road sections, particularly between the Field Station site and the next stream crossing toward the Observatory, where the steepness of the road will likely complicate effective drainage treatments. The road surface from the gate to the Field Station site has enough rock on it now to make it passable in wet weather, but beyond the field station site there is little rock and the road surface is in poor condition. Wet weather use of this section of road may contribute sediment to the stream system.

Regarding sensitive receptors, both the Field Station site and the Observatory site appear to be remote enough so that noise (particularly construction noise, since we assume that once operating there will be minimal noise-generating activity) will not be an issue. Increased traffic on Elkhorn Road could potentially cause traffic safety and noise issues. The intersection with Highway 128 should be examined for accident history and safety issues.

The biologists visited the site on Wednesday June 8, 2011.

These are ESA's initial observations, which are developed further in the report in the Environmental Impacts section in the Draft CEQA Checklist.

ARCHAEOLOGICAL INVESTIGATION

Archaeological Investigation: Summary of survey results by ASC

Kate Erickson, ASC staff archaeologist, Stacey Zolnoski, graduate student project coordinator, and Angela Lock and Jessica Tudor, archaeological technicians, spent three days (June 21 through June 23, 2011) at the Galbreath preserve. The purpose of this visit (per scope of work) was to: conduct an archaeological inventory of approximately 45-acres of the possible project locations and 3.5 miles of access road; refine the boundary of archaeological site CA-MEN-2544; and record any additional archaeological sites discovered as part of survey.

ASC personnel surveyed the length of the access road from the proposed Observatory Site to the preserve entrance on Elkhorn Road and the areas of the proposed Field Station and Observatory sites. As a result of survey, two additional sites were recorded and the boundaries of CA-MEN-2544 were refined.

Main Access Road:

Survey along the access road included 12m wide buffer where possible and potential pull-out locations. Surface visibility was good within the roadbed but varied considerably on either side with areas of dense trees and shrubs and thick duff. Two archaeological resources and 5 isolated artifacts were recorded within the roadway.

A previously recorded archaeological site (CA-MEN-2546) was re-located on the main access road approximately 0.25 mile northeast of the northern pond. The site is a small lithic scatter that is present in the roadbed. The site is approximately 30m (N/S) by 20 m (E/W).

Another previously recorded archaeological site was re-located near the northern pond (CA-MEN-2546). The site consists of a lithic scatter with two diagnostic artifacts and a possible groundstone tool. The site is concentrated near the former spring (now pond) and along the road to the north and south. Much of the lithic material is visible in the roadbed. The site is approximately 220m (N/S) by 200m (E/W).

The previous survey identified CA-MEN-2544 along the road at the southern end of the proposed Field Station location. This site will be discussed below in the Field Station section.

Observatory Site:

Survey of the proposed observatory site included areas of <7% slope along the ridgeline within the provided boundaries. Crew walked survey transects at 5m intervals within the proposed project area. Ground visibility ranged from good within the roadbed to poor in areas of dense grass and thick duff. Hoes were used to periodically clear duff and expose the ground surface for examination.

No archaeological resources were noted in this area.

Field Station Site:

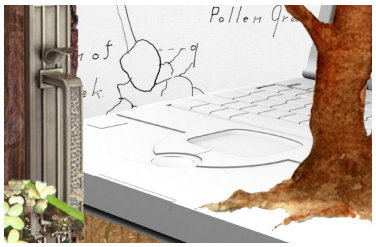
Survey of the proposed Field Station Site was similar to the Observatory Site, with 5m transects across areas of <7% slope. Once the entire proposed project area was surveyed, crew returned to the known archaeological site at the southern end. The site boundary was refined by walking 7m transects across the site with ground surface scrapes every 3m. The boundary was expanded to the south and west, but remained much the same along the north and east sides. Similar to the other recorded site, much of the lithic material is present in the roadbed and concentrated around the pond location. The site is approximately 200m (N/S) by 250m (E/W). The northern boundary of CA-MEN-2544 abuts the proposed project location boundary for the Field Station. The site boundary is based on surface observations only and the site may extend further north below the surface.

Summary

If the proposed project locations includes the sections of road where these three sites are located, and/or the portion of the Field Station Site that abuts the boundary of CA-MEN-2544, these sites will need to be evaluated to determine their eligibility to the California Register of Historical Resources.

In accordance with CEQA, “a project . . . that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment” (§15064.5[b]) Any resource that is eligible for listing in the California Register must be given consideration under the CEQA process; adverse effects to cultural resources eligible for listing on the California Register must be avoided or the effect must be mitigated.

Tab 3 :: Environmental Impacts



ENVIRONMENTAL INVESTIGATION

Environmental Checklist :: Galbreath Wildlands Preserve Field Station and Observatory

Aesthetics

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
1. AESTHETICS — Would the project:				
a) Have a substantial adverse effect on a scenic vista?		X		
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?		X		
c) Substantially degrade the existing visual character or quality of the site and its surroundings?		X		
d) Create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area?			X	

Discussion

a) The observatory site is located on a promontory overlooking the Rancheria Creek valley. The site is likely visible from many locations, including some publically accessible locations along State Route (SR) 128. Development of the observatory site, including grading, vegetation removal, and construction of new structures, could alter and adversely affect scenic vistas. Such effects could be mitigated by minimizing grading, retaining some existing vegetation to act as a screen, or planting new vegetation following construction. If possible, large trees surrounding the site should be retained, though they may be topped if necessary to provide clear views for the observatory, without substantially affecting views toward the site.

The field station site is located in a heavily wooded area. It is unlikely that any publically accessible scenic viewpoints in the area would have a view of this site, or if they did, that an adverse change would be detected, assuming that development of the site would retain some of the existing tree cover.

The existing access road is likely not visible from any publically accessible scenic viewpoints, and road improvements are not expected to cause an adverse effect on a scenic vista.

b) See the discussion of vegetation removal at the observatory site, under a), above. ESA personnel did not observe any scenic rock outcroppings or historic buildings within the areas proposed for the observatory and field station, or along the access road. Highway 128 is not a designated or candidate State scenic highway.

c) See the discussion of vegetation removal at the observatory site, under a), above. Careful design of the observatory and the observatory site would be expected to mitigate any impacts on the visual quality of the site, though the site would be altered from its current condition. Similarly, careful design of the field station site would avoid damaging that site's scenic quality, consistent with Mendocino County General Plan, Policy RM-132.[1]

d) The observatory would not be lit at night (confirm), and would be constructed of materials that would not cause daytime glare (confirm). It is assumed here that the field station buildings would be constructed of materials that would not cause daytime glare and landscaped or screened to avoid causing glare (confirm) and that both indoor and outdoor lighting would be designed to minimize the projection of night lighting beyond the site, consistent with Mendocino County General Plan Policy RM-134.[2] Construction, including road improvements, would occur during daytime hours and would not cause temporary night light effects. The project is expected to generate only minimal or occasional night time vehicle travel along Elkhorn Road, and therefore vehicle lights are not expected to cause a substantial new source of light along Elkhorn Road. Therefore, the project is not expected to cause a substantial new source of light or glare.

References

California Scenic Highway Mapping System. Scenic Highways in Mendocino County. http://www.dot.ca.gov/hq/LandArch/scenic_highways/index.htm Accessed June 15, 2011.

Mendocino County General Plan, Resource Element, adopted August 2009.

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1 Policy RM-132: Maintain and enhance scenic values through development design principles and guidelines, including the following:
- Development scale and design should be subordinate to and compatible with the setting.
- Reduce the visual impacts of improvements and infrastructure.
- Minimize disturbance to natural features and vegetation, but allow selective clearing to maintain or reveal significant views.

2 Policy RM-134: The County shall seek to protect the qualities of the nighttime sky and reduce energy use by requiring that outdoor nighttime lighting is directed downward, kept within property boundaries, and reduced both in intensity and direction to the level necessary for safety and convenience.
Action Item RM-134.1: Amend the County's Codes to incorporate standards for outdoor nighttime lighting that implement Policy RM-134.
Action Item RM-134.2: Encourage the use of motion sensors for indoor and outdoor lighting to reduce energy use.

Agricultural and Forest Resources

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
2. AGRICULTURAL 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) 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?				X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				X
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))?		X		
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?				

Discussion

a) The property is not mapped as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (California Department of Conservation, 2008).

b) The Preserve parcels that are zoned Range Land are under a Williamson Act contract (Hunt, 2011). However, the sites proposed for the field station and the observatory are not on parcels zoned Range Land, and are not under contract. See the discussion under Land Use and Land Use Planning.

c,d) Both the observatory site and the field station site are located within Assessor's parcels zoned Timber Preserve Zone. Development of these facilities may be in conflict with this zoning, and may require changes to the zoning. See the discussion under Land Use and Land Use Planning.

e) Development of the observatory, and especially of the field station, may be incompatible with the existing site zoning and general plan designation (need to confirm this). There is a question

as to whether Forest Land or Rangeland is the appropriate designation for the property, given the current use as a natural preserve.

References

California Department of Conservation, Farmland Mapping and Monitoring Program, Mendocino County Important Farmland, 2008. Map Sheet 2 of 2. November, 2010.

Hunt, Mary Lynn, Planner, Mendocino County, personal communication (telephone) with Dan Sicular, ESA, June 28, 2011.

Mendocino County General Plan, Development Element, adopted August, 2009.

Air Quality

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
3. AIR QUALITY — Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. **Would the project:**				
a) Conflict with or obstruct implementation of the applicable air quality plan?		X		
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?		X		
c) 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 (including releasing emissions which exceed quantitative thresholds for ozone precursors)?		X		
d) Expose sensitive receptors to substantial pollutant concentrations?			X	
e) Create objectionable odors affecting a substantial number of people?			X	

Discussion

a,b,c) The Galbreath Wildlands Preserve is located within the North Coast Air Basin (NCAB), as established by the California Air Resources Board (CARB). The NCAB includes Mendocino, Humboldt, Trinity, Del Norte Counties, and Northern Sonoma County. Within the air basin, Mendocino County is “non-attainment” for PM-10 (particulate matter 10 microns and less), but is “attainment” or “unclassified” for other federally-established criteria pollutants (California Air Resources Board, 2010).

The Mendocino County Air Pollution Control District (Air District) recommends use of the Bay Area Air Quality Management District CEQA significance thresholds for criteria pollutants, greenhouse gases, and toxic air contaminants, with some adjustments (Mendocino County Air Pollution Control District, 2010). The thresholds of primary concern for this project are the 82 pounds per day threshold for PM-10 and 54 pounds per day for PM-2.5: the project would result in increased traffic on Elkhorn Road, portions of which are unpaved, and also on the unpaved access road within the Galbreath Wildlands Preserve. Vehicle travel on unpaved roads would increase fugitive dust emissions, some of which falls within the PM-10 and PM-2.5 size categories. It is possible that on days with peak visitor use, during the dry season, fugitive dust emissions could exceed the PM-10 threshold, which would be considered a significant impact. Fugitive dust emissions should be minimized by applying and maintaining a rock or asphaltic concrete surface to the access road, and, if necessary, by applying a dust suppressant

to the dustiest portions of the road in the dry season. Only dust suppressants recommended by the Regional Water Quality Control Board should be used, and guidelines for water quality protection should be followed. These measures would ensure that PM-10 and PM-2.5 emissions associated with ongoing operation of the field station and observatory would be less than significant, both for the project itself, and cumulatively.[3]

The Air District's thresholds of significance for construction-related emissions specify use of Best Management Practices for dust control during construction, but not a numeric standard for fugitive dust-related PM-10. Thresholds for exhaust-related PM-10 and PM-2.5 (82 and 54 pounds per day, respectively) would likely not be exceeded, given the scale of the proposed developments. Construction contracts should require use of best-management practices, as provided by the Air District, for dust control.

The recommended threshold of significance for operational greenhouse gas (GHG) emissions is 1,100 tons per year (Mendocino County Air Pollution Control District, 2010). Sources of GHG emissions associated with operation of the field station and observatory would include transportation fuel consumption, other fuel consumption (such as propane for water heating and cooking), and, depending on the source, electricity use. Field station and observatory operations are not expected to exceed the annual threshold, but feasible steps should still be taken to minimize GHG emissions. These may include arrangement of carpools to the site to reduce private vehicle use; and use of photovoltaic and solar thermal power supplies for the field station and observatory. Such measures would further reduce the level of impact associated with GHG emissions.

Note to reviewers: is there a plan for a diesel-powered back-up generator? If so, this would require additional analysis (and depending on size, may require a stationary source permit from the Air District).

3 Mendocino County General Plan, Resources Element Policy RM-41: Reduce dust generation from unpaved roads.
Action Item RM-41.1: Adopt road standards that reduce dust and other impacts from unpaved roads.
Action Item RM-41.2: Consider imposition of an impact fee for development utilizing unpaved roads dedicated to funding projects that reduce emissions of particulate matter (i.e. paving or dust-suppression).
Action Item RM-41.3: Work with agencies and organizations to develop programs to improve and reduce emissions from unpaved roads.

d) The project is not expected to result in the emission of substantial quantities of toxic air contaminants (TACs), which could increase cancer and non-cancer health risks, nor to result in substantial concentrations of carbon monoxide (CO). The only nearby sensitive receptors potentially affected by the project are residences and ranches along Elkhorn Road, which could be affected by emissions from vehicles traveling to and from the site. The level and type of traffic generated by the project (up to several dozen passenger vehicles per day; occasional diesel trucks) is not expected to generate substantial emissions of TACs or CO, and so would not expose sensitive receptors to substantial pollutant concentrations.

e) Proposed development and operation of the observatory and field station are not expected to result in substantial odor emissions.

References

California Air Resources Board, Area Designations Maps / State and National. http://www.arb.ca.gov/desig/adm/adm.htm Accessed June 15, 2011.

Mendocino County Air Quality Management District, 2010 CEQA Information. http://www.co.mendocino.ca.us/aqmd/CEQA2010.htm Accessed June 15, 2011.

Biological Resources

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
4. 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 Game or U.S. Fish and Wildlife Service?	X			
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?			X	
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?		X		
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?		X		
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?				X

Discussion

a) Project construction has the potential to adversely affect special-status species. Bridges would be constructed across drainages at several locations, and these drainages are known to provide habitat for foothill yellow-legged frog in all life stages (reference). Western pond turtle has also been reported from the project site and may be anticipated in drainages (CDFG 2011). Critical habitat for steelhead includes drainages in the preserve boundary (CDFG 2011), and they may be present at bridge crossings. Numerous northern spotted owl territories are documented five miles from the Preserve (CDFG 2011); Preserve forests may be too arid to provide suitable habitat for northern spotted owl, and a history of logging within the last 100 years would further reduce the likelihood for this species to occur. However, if present, noise and activities associated with construction could temporarily or permanently displace owls. Sonoma tree voles are also documented five miles from the Preserve (CDFG 2011), and may be permanently impacted during tree-felling and other project activities. Large diameter trees and abundant

snags provide suitable habitat for forest-dwelling special-status bats; several sheds and vacant buildings in the Project area also provide suitable habitat. Preserve forests, snags, and rock outcrops provide suitable nesting habitat for raptors, and all vegetation in the Preserve provides suitable habitat for a wide variety of nesting birds. Suitable habitat for special status plant species, based on modeling of general habitat characteristics such as vegetation cover type and density, slope aspect, and soils and geology, occurs on the Preserve and in portions of the access road, field station and observatory sites (SSU, 2011). Focused surveys for special status species would be required to fully assess the presence and potential for impacts.

b) Project construction would not have a substantial adverse effect on any riparian habitat or other sensitive natural community. Design of bridge replacements would avoid or minimize direct impacts to riparian habitat. Construction best management practices would protect riparian habitat from indirect impacts such as temporary sediment loading and accidental spills.

c) Wetlands occur at no fewer than 23 locations along the access road, sometimes occurring adjacent to the roadway for significant linear distances. These wetlands occur as streams and seeps that support wetland vegetation. A sizable portion of relatively level terrain in the northern part of the buffer area identified for construction of the field station contains seasonal wetland, appearing to function as a headwater for a natural drainage. CALVEG landcover data provided by the client (CALVEG, 200x) did not identify wetlands other than known streams and ponds; therefore, it is unknown whether Preserve wetlands occur predominantly in association with access roads or occur elsewhere, and whether impacts associated with road improvements would significantly impact these features relative to their overall distribution and abundance in the project area. Temporary and permanent impacts to wetlands and streams may be subject to the regulatory authority of the U.S. Army Corps of Engineers, Regional Water Quality Control Board, and California Department of Fish and Game.

d) Construction activities may temporarily interfere with the movement of fish and wildlife species. No long-term impacts to movement corridors are anticipated. Use of the Preserve by northern spotted owl, Sonoma tree vole, and special-status bats should be evaluated prior to construction to avoid potentially substantial impacts to nursery sites.

e) The Mendocino County General Plan (2009) may contain policies and/or ordinances protecting biological resources (e.g., tree preservation policy). Additionally, the Preserve's status as a preserve may require that land decisions be made with certain biological objectives in mind. Further evaluation of these issues would be required to identify and resolve any conflicts.

f) No Habitat Conservation Plan or Natural Community Conservation Plan has been proposed or adopted for the Preserve, or for a larger area encompassing the Preserve. Sonoma State University has identified its management of the Preserve as being guided by the principles and

solutions identified in West Coast Watershed (2007), a collaborative management planning effort with the Mendocino County Resource Conservation District with funding from the California State Coastal Conservancy. Sonoma State University's involvement and obligations under the plan, and whether the plan has any legally binding aspects pertaining to Preserve management, would require further investigation to identify any conflicts and resolutions.

References

California Department of Fish and Game (CDFG). Rarefind 3.1, California Natural Diversity Database. Records for Big Foot Mountain, Warm Springs Dam, Tombs Creek, Gube Mountain, Ornbaun Valley, Annapolis, Cloverdale, Hopland, and Yorkville quadrangles.. Electronic database. Sacramento, CA. Accessed June, 2011.

California Native Plant Society (CNPS). Inventory of Rare and Endangered Plants (online edition, v7-11apr). Records for Big Foot Mountain, Warm Springs Dam, Tombs Creek, Gube Mountain, Ornbaun Valley, Annapolis, Cloverdale, Hopland, and Yorkville quadrangles. California Native Plant Society. Sacramento, CA. Available at: http://www.cnps.org/inventory. Accessed June, 2011.

Mendocino County General Plan, Resources Element. Adopted August, 2009.

Sonoma State University (SSU), 2011. (models of habitat suitability – citation uncertain).

CALVEG, (2004?). McClellan, CA: USDA-Forest Service, Pacific Southwest Region, Remote Sensing Lab. (various layers). [20xx?].

West Coast Watershed (2007)

Cultural Resources

Note: ESA is not scoped to complete this section.

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
5. CULTURAL RESOURCES — Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?				
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?				
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?				
d) Disturb any human remains, including those interred outside of formal cemeteries?				

Discussion

a)

b)

c)

d)

References

Geology, Soils, and Seismicity

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
6. GEOLOGY, SOILS, AND SEISMICITY — Would the project:				
a) Expose people or structures to 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 Division of Mines and Geology Special Publication 42.)				X
ii) Strong seismic ground shaking?			X	
iii) Seismic-related ground failure, including liquefaction?			X	
iv) Landslides?		X		
b) Result in substantial soil erosion or the loss of topsoil?			X	
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?		X		
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?				X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?			X	

Discussion

a.i) The observatory and field station sites are not located within a zone of an active fault delineated under the Alquist Priolo Earthquake Fault Zoning Act (California Geological Survey, 2007). The project area is located between the San Andreas Fault Zone, located about 14 miles to the west and the Maacama Fault Zone, located 12 miles to the east. Given the distance of the development site from active faults that are capable of displacement during an earthquake, surface fault rupture is not considered a constraint to site development or an environmental impact.

a.ii) Earthquakes on the San Andreas Fault Zone and the Maacama Fault will likely occur at unpredictable times over the life of the project. The distance from the project area to the major fault zones preclude the potential for violent ground shaking capable of causing serious injury

or building damage. Under the scenario for a 7.5 moment magnitude (m) earthquake on the San Andreas Fault Zone, the predicted ground shaking at the project sites would be moderate to strong. The 6.6 m earthquake scenario for a temblor generated by the Maacama Fault Zone suggests similar results (Association of Bay Area Governments, 2011). Buildings constructed at the project sites would be designed to comply with current building codes, which are designed to reduce the risk of structural collapse and limit damage. While ground shaking is expected at the project site, it does not present a development constraint and is not considered an environmental impact.

a.iii) Seismic ground failure, such as liquefaction, could occur at certain areas of the observatory and field station sites, however, the risk of damage to built structures or other developed features would be low because both development areas are underlain by competent bedrock that would attenuate ground motion. Additionally, each area supporting structures or other improvements would be evaluated during the design level geotechnical assessment, which would be completed for this project to identify problematic soil and bedrock conditions. While ground failure and liquefaction could occur locally in certain saturated cohesionless sediments, the potential is not considered a development constraint or environmental impact.

a.iv) Slopes in the field station site range from 0 to 7 percent and are therefore not susceptible to failure during an earthquake. Engineered slopes (e.g. roadway cuts, building pads, slope repairs) also have a low potential of failure from seismic ground motion. However, slopes flanking the observatory site are considerably steeper, particularly slopes on the north and northeast boundary. Field reconnaissance of the observatory site (conducted by ESA, June 2, 2011) identified features suggesting that the steep north-northeast slopes have in the past and currently experience creep due to loosely consolidated, weathered bedrock (e.g. sandstone), slope aspect, and steepness. Slope failure could be triggered during an earthquake and is considered a constraint to observatory site development and would require geotechnical evaluation. Static (non-earthquake conditions) and pseudo-static (earthquake conditions) slope stability analysis should be conducted focusing on the response of the slope following observatory site development. Appropriate slope stability assessment and recommendations for slope improvements would reduce this potentially significant impact.

b) The observatory and field station sites are underlain by ancient marine rocks of the Tertiary and Cretaceous age Coastal Belt Franciscan Complex (Wagner and Bortugno, 1982). Overlaying the bedrock are the Casabonne-Holohan-Wohly soils series that are described as moderately deep to very deep, strongly sloping to very steep, well drained soils that formed in material weathered from sandstone; on hills and mountains. These soils occur on hilly and mountainous uplands with vegetation consisting mainly of Douglas-fir and tanoak at elevations from 500 to 4,235 feet. Hard sandstone bedrock is at a depth of 40 to 60 inches and slopes range from 9

to 75 percent (NRCS, 1999). The soils at the projects sites are not considered Prime Farmland Soils or Soils of Statewide Importance. Erosion potential at the field station site is expected to be minimal given the overall slope and proposed land use. Soil erosion occurring during construction would be kept at a minimum through standard construction best management practices and requirements of the NPDES General Construction Permit (see Hydrology and Water Quality). Landscaping, stormwater management features, and drainage designs would manage soil erosion during operations at the field station. Soil erosion at the observatory site may be more prevalent due to 1) the steep flanking slopes, 2) the need to construct the access road along the narrow ridge, and 3) proposed tree removal. Standard erosion controls would be required to manage soil erosion during construction of the observatory site. Once constructed, continued erosion at the observatory site would be reduced through standard stormwater controls, road design, and limiting access to areas containing natural soils. The highest erosion risk would be along the roads that access the field station from Elkhorn Road and from the field station to the observatory site. These roads have been previously surveyed and results of the evaluation are presented in the document titled, *Draft Summary Report, SSU Galbreath Wildlands Preserve Road Drainage Improvements, Mendocino County, California*, conducted by Pacific Watershed Associates (PWA) in March 2007. The PWA study identified erosion issues on the roads and provided recommendations for remedies to reduce erosion and soil loss on roads that appeared to be inadequately designed, poorly maintained, and damaged by runoff and flooding. Soil erosion and loss of topsoil are not considered a development constraint or an environmental impact provided that erosion management techniques are employed during construction of roads and facilities and throughout the operation of the project.

c) See the discussion in items (a) and (b) above. The risk of slope instability on the slopes flanking the observatory site is moderate to high and would require geotechnical evaluation. While landslides can be triggered by earthquakes, slope failures can also be caused by forces of gravity acting on the slopes such as undercutting of the toe, increasing the weight on the top of the slope, saturation, or increasing steepness. Without adequate geotechnical evaluation and treatment, slope stability would be a development constraint. Furthermore, the removal of trees from steep slopes surrounding the observatory site could increase the risk of slope failure because the tree roots hold soil to the slope and the trees extract water from the slope; removing trees from slopes reduces the slope equilibrium and factors of safety. To help maintain slope stability, it is recommended that certain trees be topped (shortened) and remain on the slope rather than removing the entire tree.

d) Expansive soils are not considered a development constraint because the soils underlying the proposed building and roads are expected to be well drained with low shrink swell potential. Nevertheless, geotechnical assessment completed prior to facility design would evaluate existing soil conditions and if expansive soils are identified, they could be removed and replaced

or conditioned to reduce expansivity. Expansive soils are a standard geotechnical issue and with adequate engineering solutions can be reduced to a less than significant environmental impact.

e) See results of septic testing elsewhere in this report.

References

Association of Bay Area Governments (ABAG). Earthquake and Hazard Program, Earthquake Shaking Maps and Information. Interactive Web Page http://quake.abag.ca.gov/shaking/. Accessed June, 2011.

California Geological Survey (CGS), *Fault-Rupture Hazard Zones in California:* Alquist-Priolo Special Studies Zones Act of 1972 with Index to Special Studies Zones Maps, California Geological Survey, Special Publication 42, Interim Revision, 2007.

Natural Resource Conservation Service (NRCS), *Soil Survey of Mendocino County*, *Western Part*, United States Department of Agriculture, 1999.

Wagner, D.L. and Bortugno, E.J. *Geologic Map of the Santa Rosa Quadrangle,* Regional Geologic Map Series, Map No. 2A, California Department of Conservation, California Geological Survey, 1:250,000, 1982.

Greenhouse Gas Emissions

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
7. GREENHOUSE GAS EMISSIONS — Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?		X		
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?		X		

Discussion

a) See Air Quality discussion.

b) See Air Quality discussion regarding CEQA significance thresholds for project operations. Mendocino County has not adopted a Climate Action Plan; however, the General Plan, Resource Element contains the following policies and action items:

> Policy RM-50: Mendocino County acknowledges the real challenge of climate change and will implement existing strategies to reduce greenhouse gas emissions and incorporate future measures that the State adopts in the coming years.
>
> > Action Item RM-50.1: Inventory existing and historical sources of greenhouse gas emissions in Mendocino County. Coordinate those efforts with other jurisdictions to ensure completeness and avoid unnecessary duplication.
> >
> > Action Item RM-50.2: Create a greenhouse gas reduction plan for the unincorporated areas of the county that sets specific reduction strategies and targets to meet.
> >
> > Action Item RM-50.3: Reduce Mendocino County's greenhouse gas emissions by adopting measures that reduce the consumption of fossil fuel energy resources.

Measures specified in the Air Quality discussion would reduce GHG emissions and would be consistent with this policy.

References

Mendocino County General Plan, Resources Element. Adopted August, 2009.

Hazards and Hazardous Materials

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
8. 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?			X	
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?			X	
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				X
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 for people residing or working in the project area?				X
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?				X
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				X
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?			X	

Discussion

a,b) The project would not involve routine use, transportation, or disposal of hazardous materials. Small quantities of hazardous materials, such as solvents, fuel, motor oil, cleaning products, and laboratory supplies, should be kept in original, labeled containers and storage cabinets. Construction contractors should be required to store hazardous construction materials, including fuel, hydraulic fluid, and motor oil used in construction equipment, in properly labeled containers and storage cabinets; to designate fueling stations away from waterways and sensitive biological resources; to maintain all equipment in proper working order; and to maintain clean-up supplies in case of minor spills or leaks.

c) The Galbreath Wildlands Preserve is not located in proximity to an existing or planned school.

d) Note to reviewers: is there a plan to conduct a Phase I investigation? If not we can research the hazmat sites lists.

e,f) The Galbreath Wildlands Preserve is not located within an airport land use plan or within two miles of a public airport or public use airport, and would not result in a safety hazard for people residing or working in the project area. Neither is the project located within the vicinity of a private airstrip.

g) There is no (known) emergency response plan or evacuation plan for the Preserve or the area in which the Preserve is located.

h) Both the observatory site and the field station site are in areas subject to wildfire. To protect site users from the threat of wildfire, proper clearance should be maintained around structures, a water supply sufficient for firefighting should be available at each site, and the access roads maintained to allow for passage of emergency vehicles. Sprinkler and alarm systems should be included in any inhabited structures. See also specific recommendations and requirements in report section on fire protections services.

References

See notes on communications with Anderson Valley Volunteer Fire Department and CalFire, elsewhere in this report.

Hydrology and Water Quality

Issues (and Supporting Information Sources):		*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
9.	**HYDROLOGY AND WATER QUALITY — Would the project:**				
a)	Violate any water quality standards or waste discharge requirements?			X	
b)	Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?			X	
c)	Substantially alter the existing drainage pattern of a site or area through the alteration of the course of a stream or river, or by other means, in a manner that would result in substantial erosion or siltation on- or off-site?			X	
d)	Substantially alter the existing drainage pattern of a site or area through the alteration of the course of a stream or river, or by other means, substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?			X	
e)	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?			X	
f)	Otherwise substantially degrade water quality?			X	
g)	Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?				X
h)	Place within a 100-year flood hazard area structures that would impede or redirect flood flows?				X
i)	Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?				X
j)	Expose people or structures to a significant risk of loss, injury or death involving inundation by seiche, tsunami, or mudflow?				X

Discussion

a) The proposed field station site is on a relatively level upland ridge area (1,880 feet above mean sea level) that is not adjacent to or in direct connection with a perennial stream (USGS, 1991a). Drainage from this site enters natural swales that represent the upper most boundaries of a sub-watershed within the Rancheria Creek watershed. The proposed observatory site is at an elevation of 1,680 feet above sea level on a ridge that drains to Rancheria Creek (USGS, 1991b). The road system throughout the Galbreath Wildlands Preserve intersects and traverses ridges that eventually drain to the Rancheria Creek watershed.

During the construction phase, the project would be required to comply with State Water Resources Control Board Order Number 2009-0009-DWQ (as amended by Order No. 2010-0012-DWQ) NPDES General Permit No.CA000002 (General Permit), which regulates discharges of stormwater associated with construction and land disturbing activities. The General Permit requires that stormwater be managed in such a way as to avoid discharges of sediments and other pollutants to the waters of the U.S. Compliance with the order would require, for example, a Stormwater Pollution Prevention Plan, discharge monitoring (if applicable), and Best Management Practices (BMPs) to ensure that land disturbing activities do not cause erosion and sediment delivery to creeks or the release of other chemicals used in construction. Required compliance with the General Permit would avoid violations of water quality standards and waste discharge requirements and, therefore, construction phase water quality issues are not considered a constraint to the project.

The proposed field station and observatory site are far enough away from Rancheria Creek and its tributaries to preclude direct discharges to streams, but indirect discharges could occur. Post construction BMPs required under the General Permit (if any), as well as project elements that reduce and manage stormwater runoff would further reduce potential project-related sediment and pollutant discharges. Design elements that reduce stormwater runoff and treat pollutants from a site can include bioswales, rain gardens, pervious roadways and paths, retention basins, and rain water harvesting from roofs. These features compensate for the additional imperviousness and runoff that are a result of site development. Runoff control and water treatment features should be integrated into the design for the field station and observatory sites.

Road system conditions and recommended improvements to correct erosion and failure issues are presented in the *Draft Summary Report, SSU Galbreath Wildlands Preserve Road Drainage Improvements, Mendocino County, California*, conducted by Pacific Watershed Associates (PWA) in March 2007. The recommended improvements would reduce erosion and the sediment contribution to the Rancheria Creek watershed and its tributaries. Sedimentation from the existing road system is not considered a constraint of the project, however, because these problematic conditions would be improved and sediment sources reduced: road improvement can be regarded as a project opportunity and environmental benefit.

b) Groundwater may be the preferred water source for the field station site. There is not enough available information to determine whether adequate groundwater resources exist beneath the site or if the use of groundwater would be a project constraint. Determining the feasibility of groundwater development at the field station would require a hydrogeologic assessment, which could involve drilling test borings, sampling for groundwater quality, and conducting pump tests to determine the aquifer yield. Groundwater supply wells would be designed based on the results of the hydrogeologic assessment. Given the bedrock geology (Franciscan Complex), it is likely that the groundwater is found within the bedrock fractures and therefore, if it is available at a reasonable depth, groundwater could be low quality

and require filtration and possibly treatment. Groundwater, if available, would likely be a more reliable source of water supply than surface water from streams. Groundwater production (if feasible) in concert with stormwater detention and rainwater harvesting may provide an adequate and reliable water supply. If groundwater is available for production at the field station site, it is not likely that groundwater pumping would interfere with other groundwater users. Groundwater pumping would not be considered an environmental impact associated with the project.

c) Please also see discussion under Item (a). The field station site is a relatively level site with slopes between 0 and 7 percent. The majority of the facilities supporting the observatory would be placed in this location and consist of cabins, meeting areas, dining facilities, and parking. The proposed development would not substantially alter the site topography and thus, existing drainage patterns would not change significantly: site design would incorporate existing drainage patterns. Flooding potential on this upland ridge site is very low especially considering the drainage improvements that would come about by developing the site. The proposed project presents an opportunity to introduce development concepts to promote natural infiltration, bio-treat stormwater, increase perviousness, and reduce erosion.

The observatory site and access road would not adversely alter drainage patterns but the increased imperviousness may increase stormwater runoff quantities to some degree. Given the size of the observatory facility, the magnitude of increased imperviousness would not be substantial and could be offset by runoff control BMPs such as rock aprons, vegetated slopes, pervious surface materials, or rainwater harvesting. Drainage on either the field station site of observatory would not be a project constraint.

d) See discussion under item (c).

e,f) See discussion under items (a) and (c).

g,h,i,j) The project area is situated on an upland ridge and outside any 100-year flood area, tsunami hazard area or mudflow. The potential for flooding on an upland ridge is very low although localized flooding in low areas could occur due to excessive rainfall. Remedies to reduce localized ponding and flooding would be introduced in the site drainage and grading plan.

References

United States Geological Survey (USGS), *Gube Mountain Quadrangle, California.* 7.5 Minute Series (Topographic), 1:24,000 Scale, Provisional Edition, 1991a.

United States Geological Survey (USGS), *Big Foot Mountain Quadrangle*, *California,* 7.5 Minute Series (Topographic), 1:24,000 Scale, Provisional Edition, 1991b.

Land Use and Land Use Planning

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
10. LAND USE AND LAND USE PLANNING — Would the project:				
a) Physically divide an established community?				X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?		X		
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?				X

Discussion

a) The project site is in a remote rural area. The specific sites proposed for development are within the boundaries of a large land holding, and development would not physically divide an established community.

b) The project site consists of several Assessor's parcels. Some parcels have a General Plan land use designation and zoning of RL- Rangeland, and others are designated FL-Forest Land, and zoned TPZ-Timber Preserve.

According to the Mendocino County General Plan Development Element (Mendocino County, 2009), the Range Lands classification is intended to be applied to lands which are suited for and are appropriately retained for the grazing of livestock. The classification includes land eligible for incorporation into Type II agricultural preserves, other lands generally in range use, intermixed smaller parcels and other contiguous lands, the inclusion of which is necessary for the protection and efficient management of range lands. The policy of the County and the intent of this classification is to protect these lands from the pressures of development and preserve them for future use as designated.

General Uses for Range Lands include residential uses, agricultural uses, forestry, cottage industries, residential clustering, uses determined to be related to and compatible with ranching, conservation, processing and development of natural resources, recreation, utility installations. Minimum parcel size is 160 acres, with a maximum dwelling density of one dwelling per 160 acres. County review and approval are required for more than one dwelling per legally created parcel.

The parcels zoned Range Land are in a Williamson Act contract, which restricts development to uses consistent with agriculture and open space.

The Forest Lands classification is intended to be applied to lands which are suited for and are

appropriately retained for the growing, harvesting and production of timber and timber-related products. The classification includes lands eligible to be zoned Timberland Production (TP or TPZ); intermixed smaller parcels and other contiguous lands, the inclusion of which is necessary for the protection and efficient management of timber resource lands. The policy of the County and the intent of this classification is to protect these lands from the pressures of development and preserve them for future use as designated.

General Uses for Forest Lands include residential uses, forestry, timber processing, agricultural uses, cottage industries, residential clustering, uses determined to be related to and compatible with forestry, conservation, processing, and development of natural resources, recreation, and utility installations. Minimum parcel size is 160 acres, and maximum dwelling density is one dwelling per 160 acres. County review and approval is required for more than one dwelling per legally created parcel.

The parcels within the property designated Forest Lands are zoned TPZ-Timber Preserve Zone. The TPZ zoning places restrictions on site development consistent with the use of the land for timber production.

Both the observatory site and the field station site are within parcels zoned TPZ. Development of the planned facilities may therefore require rezoning of the parcels, which would require a County Planning Commission hearing and approval by the State Board of Forestry (Hunt, 2011).

c) The project site is not within a habitat conservation plan or natural community conservation plan area.

References

Hunt, Mary Lynn, Planner, Mendocino County, personal communication (telephone) with Dan Sicular, ESA, June 28, 2011.

Mendocino County General Plan, Development Element. Adopted August, 2009.

Mineral Resources

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
11. 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?				X
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?				X

Discussion

a,b) The Mendocino County General Plan does not contain a map of known mineral resources, nor does it delineate locally important mineral resource recovery sites. ESA did not observe developed mineral resource sites, such as quarries, on either the observatory site or at field station site during site visits.

References

Mendocino County General Plan, Resources Element. Adopted August, 2009.

Noise

Issues (and Supporting Information Sources):		*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
12.	**NOISE — Would the project:**				
a)	Result in Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?			X	
b)	Result in Exposure of persons to, or generation of, excessive groundborne vibration or groundborne noise levels?			X	
c)	Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?			X	
d)	Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?			X	
e)	For a project located within an airport land use plan area, or, where such a plan has not been adopted, in an area within two miles of a public airport or public use airport, would the project expose people residing or working in the area to excessive noise levels?				X
f)	For a project located in the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?				X

Discussion

a,b,c,d) The existing ambient noise environment within the Galbreath Wildlands Preserve is very quiet: during ESA's site visits no noise (i.e., unwanted sound) from sources within the property or from off of the property could be detected, other than very infrequent passenger vehicles. The project would generate new sources of noise, including construction noise, noise from occupation and use of the field station, and from vehicles travelling to and from the site. The only noise-sensitive receptors in the vicinity are several residences along Elkhorn Road (residences along State Route 128 are already noise-impacted; furthermore, project-associated traffic would not substantially increase traffic noise on SR 128). Most of these residences are located at least 100-200 feet from the roadway, and would experience only a very slight increase in average ambient noise levels from increased vehicle traffic on Elkhorn Road. Furthermore, most vehicles travelling to and from the site will do so during daylight hours (nighttime noise is perceived as louder or more bothersome than daytime noise).

Construction noise would be of limited duration, and limited to daylight hours; it is unlikely that it would be audible for residents in the vicinity. Ongoing use of the field station site is expected to generate only low levels of noise, which would not be detected by off-site receptors. After construction, noise levels at the field station site itself would be expected to be compatible with its use as an educational facility with overnight accommodations, and would likely meet the "completely compatible" standard for residential uses contained in the Mendocino County General Plan, Development Element, Policy DE-101 (less than

55 dBA; this is the most restrictive standard listed) In short, the project is not expected to expose persons to excessive noise levels. (Need to confirm whether construction will require any pile driving; if not, groundborne vibration would not be expected to be significant).

e,f) The project site is not within an airport land use plan area or in proximity to a public or private airstrip.

References

Mendocino County General Plan, Development Element. Adopted August, 2009.

Population and Housing

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
13. POPULATION AND HOUSING — Would the project:				
a) Induce substantial 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)?				X
b) Displace substantial numbers of existing housing units, necessitating the construction of replacement housing elsewhere?				X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?				X

Discussion

a,b,c) The project would not induce any population growth in the area, as it does not propose new homes or infrastructure beyond that required for the project itself, which is a non-residential use. The project would not displace existing housing units, and would not displace any people.

References

None cited.

Public Services

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
14. PUBLIC SERVICES — Would the project:				
a) Result in substantial adverse physical impacts associated with the provision of, 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 following public services:				
i) Fire protection?			X	
ii) Police protection?			X	
iii) Schools?				X
iv) Parks?				X
v) Other public facilities?				X

Discussion

a.i) See notes on communications with Anderson Valley Volunteer Fire Department and CAL Fire, elsewhere in this report

a.ii) The project would likely result in infrequent calls for police protection. Police protection for the area is provided by the Mendocino County Sheriff's Department. Currently, two Sheriff's deputies are resident in Anderson Valley, and additional Sheriff's personnel are dispatched from Ukiah.

a.iii, a.iv, a.v) The project would not result in increased demand for schools, parks, or other public facilities.

References

See notes on communications with Anderson Valley Volunteer Fire Department and CAL Fire, elsewhere in this report.

Recreation

Issues (and Supporting Information Sources):		*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
15.	**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 facilities would occur or be accelerated?				X
b)	Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?				X

Discussion

a,b) The project would not increase the use of existing parks or other recreational facilities, nor would it include the construction or expansion of recreational facilities.

References

None cited.

Transportation and Traffic

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
16. TRANSPORTATION AND TRAFFIC — Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?			X	
b) Conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?				X
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location, that results in substantial safety risks?				X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?		X		
e) Result in inadequate emergency access?		X		
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?			X	

Discussion

a) The project site is accessed by State Route 128 and Elkhorn Road, and then a private driveway within the Galbreath Wildlands Preserve itself. The driveway begins about five miles from the state highway. SR 128 is a two-lane undivided highway, with occasional turnouts to allow passing. Recent data published by Caltrans indicates that the average daily traffic volume on SR 128 in the project area is about 1,850 vehicles (Caltrans, 2010). Elkhorn Road is a lightly-used, two-lane County road that intersects with SR 128 about 1/4-mile west of the town of Yorkville. The location of the intersection is marked with signs from both directions on SR 128. Elkhorn Road provides access to several rural residences and large ranches in the vicinity of Yorkville, but is not a through road, ending at a private driveway just past the gate to the Galbreath Wildlands Preserve.

The project **may** generate up to about 50 passenger vehicles per day, during days of peak use of the field station [**NOTE: confirm [50 vehicles = 100 one-way trips on SR 128**]. The increase in daily volume on SR 128 (about **five** percent), on Elkhorn Road, and at the Elkhorn Road / SR 128 intersection would be noticeable to drivers currently using those roads, but the traffic volumes under project conditions would be less than the expected carrying capacity of the roads.[1]

1 The carrying capacity of two-lane rural roads is generally higher than 5,000 vehicles per day.

The Mendocino County General Plan Development Element does not contain any specific policies or standards regarding performance standards on Elkhorn Road or the Elkhorn Road / SR 128 intersection. The project does appear to be compatible with General Plan Policy DE-140 (Maximize the use of existing road systems and reduce environmental and community disruption through compatible land use planning) because it would utilize the existing road system, and the proposed land use is generally compatible with surrounding uses.

b) Mendocino County has no congestion management agency, and has not established level of service standards for Elkhorn Road or SR 128 in the vicinity of Yorkville.

c) The proposed project would not have the potential to change air traffic patterns at any airport, and the project components would not involve the installation of structures that could interfere with air space. No impact would occur.

d) SR 128 does not have designated turn lanes or acceleration/deceleration lanes at the intersection with Elkhorn Road. Sight lines for drivers traveling in both directions on SR 128 are limited. Increased use of this intersection could increase the risk or incidence of accidents. (**Note to reviewers – ESA is requesting CHP data on the accident history of this intersection**). The greatest risk hazard likely would occur when vehicles traveling westbound on SR 128 attempt to turn left onto Elkhorn Road. To reduce the risk of accident, directions provided to Preserve visitors should include the suggestion that drivers traveling west on SR 128 proceed past Elkhorn Road the 1/4-mile to the town of Yorkville, where they may safely turn around and then turn right onto Elkhorn Road from eastbound SR 128. The directions should also caution drivers to observe posted speed limits on Elkhorn Road. Another option would be to prohibit left turns from westbound SR 128 to Elkhorn Road.

Elkhorn Road is a narrow, winding road that has only gravel surface for much of its length. It has several sharp turns with limited sight lines. The Director of Transportation for Mendocino County expressed some concern regarding safety issues associated with increased use of Elkhorn Road (Peters, 2011).

e) See notes on communications with Anderson Valley Volunteer Fire Department and CalFire, elsewhere in this report

f) Several policies in the Mendocino County General Plan Development Element encourage use of carpools, transit, and bicycles. However, public transit does not serve the project site, and width and alignment constraints make SR 128 unattractive to bicyclists. The proposed project would not permanently change the existing or planned transportation network in the project area and therefore would not conflict with policies, plans, or programs related to transit, bicycle, or pedestrian travel. SSU should, however, consider

establishment of a policy to encourage and facilitate use of carpools to the Preserve, particularly for events at the field station.

References

California Department of Transportation (Caltrans), *2009 Traffic Volumes on California State Highways*, 2010.

Mendocino County General Plan, Development Element. Adopted August, 2009.

Peters, Tom, Director of Transportation, Mendocino County. Personal communication (telephone) with Dan Sicular, June 28, 2011.

Utilities and Service Systems

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
17. UTILITIES AND SERVICE SYSTEMS — Would the project:				
a) Conflict with wastewater treatment requirements of the applicable Regional Water Quality Control Board?			X	
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?			X	
c) Require or result in the construction of new storm water drainage facilities, or expansion of existing facilities, the construction of which could cause significant environmental effects?		X		
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?			X	
e) Result in a determination by the wastewater treatment provider that would serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				X
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?			X	
g) Comply with federal, state, and local statutes and regulations related to solid waste?			X	

Discussion

a) The field station site will be served by a permitted septic system.

b) The field station site will use a septic system and likely will have its own water supply, storage, and treatment system. It is likely that this system will be located within the footprint of the field station site, that it would be small and compatible with the scale and style of development, and that it would not cause significant environmental impacts. See also the discussion of groundwater in the Hydrology section.

c) Site drainage at the field station site will not connect to a municipal stormwater system. See recommendations for managing stormwater under Hydrology, above.

d) The field station would likely be supplied with water from a well drilled on the site. No new entitlement would be required for drilling a well, but Mendocino County does permit new wells.

e) The project site would be served by septic systems, not a wastewater treatment system.

f) Currently, there are no remaining operating landfills in Mendocino County. Solid waste generated in the County is exported for disposal to the Potrero Hills Landfill in Solano County (Mendocino County, 2009). This landfill is currently applying for an expansion that would provide several decades of capacity. (Need to discuss how waste would be handled at the field station. The field station site should be designed to accommodate or enhance source separation and recycling of wastes.)

g) Inclusion of recycling facilities would ensure compliance with the County Source Reduction and Recycling Element, which has as a goal the diversion from landfill of 50 percent of generated waste. The County achieved this goal in 2004.

References

Mendocino County General Plan, Development Element. Adopted August, 2009.

Mandatory Findings of Significance

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
18. MANDATORY FINDINGS OF SIGNIFICANCE — Would the project:				
a) Have the potential to 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, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?		X		
b) 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)?			X	
c) Have environmental effects that would cause substantial adverse effects on human beings, either directly or indirectly?				X

Discussion

a) See Biological Resources discussion.

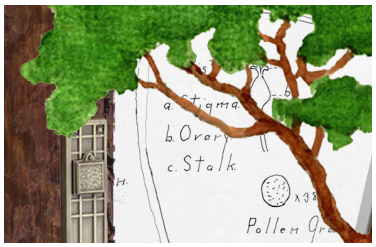
b) Potential project impacts are less than significant, or can be mitigated, and would not be expected to contribute to any cumulative impacts.

c) The project would not imperil nor put at risk human beings. Minor safety risks (e.g., traffic, geologic hazards) can be mitigated to less than significant.

References

None cited.

Tab 4 :: Program Research



AUTHORITIES HAVING JURISDICTION

RIM Architects (RIM) contacted several organizations to determine which parties would have input into the planning and design of the Galbreath Field Station Project. The following parties were determined to have jurisdiction over the property development, including permit review and assistance.

Anderson Valley Fire Department

Steve Kushner (RIM) contacted the Colin Wilson, Fire Chief for the Anderson Valley Volunteer Fire Department to clarify their involvement with emergency response to the Galbreath site. The following was discussed:

- Anderson Valley FD is the first response for all emergency calls in the area. They can provide ambulance and helicopter evacuation, if needed. Colin is quite familiar with the Galbreath site.
- For permitting, Colin will only review documents if the project is Public Assembly for a gathering of over 50 people. It was shared that we anticipated that the project would not be as such, but that it was not outside impossible for it to end up that way.
- Colin described the state of the roads in the area and his understanding of what would be required. For any facility that is not Public Assembly of over 50 persons, he believes all that is required is a driveway complying with the standards of **Public Resources Code sections 4290 (construction) and 4291 (maintenance)**. Some of the requirements he noted were: a minimum of a 10' drive width, less than 16% slope, well-rocked gravel road supporting 80,000 lbs for year-round access, and pull-outs for other vehicles to allow emergency vehicles to pass, if the driveway is over a certain distance. These requirements become more stringent if the facility is Public Assembly of over 50 persons, such as increasing the width to 16'-20', while still being a gravel road. He thought paving was excessive for the area. He also suggested that the roads he is familiar with all comply to this standard now for the logging that has been done in the area.
- Colin recommended that whatever we do we name any new roads and put up a road sign, which will help them locate the facility and will help emergency callers describe where they are.
- Colin was not aware of any increased requirements for the building construction to be fire resistant due to remote location, but did recommend that all remote facilities like this have a gravity-fed water supply for on-site use. There are many different types that he can help determine the best kind. We discussed rain-water collection systems as well as shared potable water / fire suppression water systems. However, he did not say that is was a requirement of the project, again until the use was Public Assembly.

- Helicopter service could be provided and would need a reasonable clearance of about 250' in diameter. He didn't think that would be a problem, but referenced the Galbreath Ranch.
- He suggested that we would still need a driveway to access the observatory, but when the daily usage was described offered that there are some facilities that would not require 4290 regulations based on typical occupancy.
- Colin also expressed interest in remaining involved during the planning and design of the project, willing to assist our team up front to help avoid problems later. We recommend this as well.

CAL Fire

Steve Kushner (RIM) contacted the California Division of Forestry and Fire Protection (CDF or CAL FIRE) to determine their involvement with emergency response to the Galbreath site. The following was discussed:

- CAL Fire is the Fire Authority for Mendocino County. They will review and approve all projects. Our contact with CAL Fire Prevention is Shawn Zimmermaker at 707.459.7424.
- CAL Fire's local station in Boonville is summer-only and for the purpose of fighting wildfires.
- CAL Fire is the dispatching authority for the area. The local emergency response is through Anderson Valley Volunteer Fire Department, which handles fire and ambulance. Our contact at AVVFD is Fire Chief Colin Wilson, 707.895.2020.
- After hearing the description of the proposed usage of the site Shawn suggested that he thinks we will need two permits that can be linked together: a regular building permit and a use permit. With the use permit, our project will need to meet 4 or 5 requirements –
    - The new road will need to be named and an address given to the building. The road / driveway will need a sign at the last county road, which would be Elkhorn Road.
    - The new road will have to meet the regulations as included in the Public Resources Code Section 4290. The requirements can be found in Tab 2: SITE EVALUATION
    - The building will need to be constructed with all appropriate site setbacks taken into account.

- The site must be cleared to provide 100' of defensible space around the building. There are stages to the plantings allowed within this area.
- There may be a requirement for on-site water supply for fire suppression. This could be achieved with a tank to collect rain water.

- There is a width requirement based on the occupancy type and load of the building. Having large groups on-site but no "building assembly" spaces will not require road modifications, but CAL Fire does suggest some additional site design methods that will be helpful.
- Shawn also suggested that there are some exceptions to the requirements of 4290:
  - The 16% maximum slope can be increased to 20% for paved areas.
  - On a well-constructed gravel road, CAL Fire will visit the site to look at the conditions. If the general slope before and after a steeper than 16% slope area is relatively flat, they may sign off on it as acceptable.

Upon finding this information, Shawn Zimmermaker with CAL Fire attended a site visit with Claudia Luke of SSU and Richard Ingram, Charlie Fisher, and Dana Brock of Brelje & Race to look at the portions of the existing road that did not comply with the 4290 driveway standards, primarily sections over the 16% maximum slope. The results of their meeting were documented and agreed upon via email in the following manner:

> Dear Shawn,
>
> Thank you for meeting me, Brelje & Race Vice President Richard Ingram, and his staff Dana Brock and Charlie Fisher, on Friday May 27th at SSU's Galbreath Wildlands Preserve to discuss access roads for the proposed field station and observatory facilities. The weather was generally clear and rain had preceded our site visit. We drove the main access road from the front gate to the proposed observatory turn off. For this section of road, you gave us feedback that:
>
> 1. Much of the roads length met CalFire access criteria for grade (i.e., < 16% grade on dirt roads) but would need to developed with an all-weather surface.
> 2. For the sections of the road that did not meet these criteria, CalFire would be willing to work with existing road grades if appropriate mitigation were proposed. Potential mitigations include combinations of additional turnouts, turn-arounds, road widths, surfacing, drainage improvements and on-site water storage.
> 3. We will be responsible for proposing the mitigations for grade exceedances through the permit

application process. Rough but clear drawings will be sufficient for CalFire to review our permit proposal.

4. You did not see an fundamental problems on the roads that would make it difficult for Cal Fire to approve an exemption application, and felt that access for emergency purposes with appropriate mitigation would likely allow CalFire's to recommend approval to the County as part of the use permit process.

The information you provided was very helpful in enhancing our understanding of emergency access needs. As we mentioned, access development is a critical piece of our planning process and will determine the types of facilities we may be able to provide to enhance education and research in the region.

Thanks so much for providing edits which we incorporated in this email to document that SSU, Brelje & Race, and CalFire agreed on the results of our trip to the Preserve.

Sincerely,

Claudia

Dr. Claudia Luke,
Director SSU Field Stations & Nature Preserves
Sonoma State University

In addition, Shawn Zimmermaker provided the following input on the observatory site and access:

- Shawn at CAL Fire suggested first that all structures must have access in compliance with 4290. However, based on use and further discussion, exemptions can be made.
- It will be important as the project develops to determine what other provisions we can provide if slopes in compliance with 4290 are not acceptable. These provisions may include designated cleared areas that occupants can access safely in an emergency until help can arrive; additional clearing away from the building beyond 100'; or fire suppression systems at the observatory.

Mendocino County

Mendocino County has been determined to be the primary permitting authority for the project. Our limited discussions with the county outlined zoning regulations and permitting requirements. Our findings included:

- Steve Kushner spoke with Mary Lynn Hunt of Mendocino County. Unfortunately, she was

not at all familiar with the Galbreath Preserve or the area described to her. She indicated there were many regulations depending on the type of development and where it was located. In order to provide assistance, she has requested an assessor's parcel number for the site and a better description of the access location – will our new road be in an existing, private easement? Or is it directly off a county road? Further contact was required, as well as finding this information in order to make progress.

- Once the parcels had been provided to us, we were able to determine that the Galbreath property is made up of several parcels in two Zoning districts – Rangelands and Forest Lands. Depending on how we choose to develop the property, it appears that the Field Station will be of the intended uses of the property and will not require public hearing to allow development. A second issue was raised about development of buildings along the parcel lines – which would in general be required to be set back from the parcel line or constructed with fire-rated assemblies. Claudia Luke shared that the University is in the process of modifying the property into one large parcel and/or place restrictions on future development to essentially achieve the same single property consideration. This activity is not included as part of this project but will impact permitting if not completed.
- Our project should only require the standard building permits for development.
- Further discussion with Mendocino County is anticipated.

Division of the State Architect (DSA)

As this project will be owned by SSU, in the California State University system, supported by state public funding (regardless of the private donor sponsorship of the project), it will require review by DSA. At the University level, DSA only reviews Seismic design for Essential Facilities such as hospitals or emergency call stations, to which our project does not apply. DSA conducts Accessibility reviews for all state-funded facilities. Volume 1 of the 2010 CBC highlights requirements for DSA under 1.9.1.

DSA Oakland is the regional office with jurisdiction of our site and we met with their representative, Ally Watts, on Monday May 23 at 1:30 p.m. She provided information on accessibility requirements for the site and buildings, including:

- The DSA website has an extensive project checklist that is organized by project type that outlines all accessibility requirements. This will be of great benefit.
- Site access must be provided in some way, be it commuter vehicles or other method, and include a loading / unloading area and designated parking.
- A slip-resistant, trip-free path must be provided between structures and within structures.

Perforated pavers are a way of achieving pathways. Also wood boardwalks are a good installation.

- 5% of project accommodations must be accessible. Building provisions do not need to be constructed immediately, but accounted for in design. For example, if there are 10 living spaces, at least one must be constructed such that a closet hangar rod can be mounted at multiple heights, or that countertops are installed with adjustable surfaces.
- She informed us of special wheelchairs made for difficult terrain that SSU may be able to provide.
- The caretaker's residence must be designed as accessible for adaptability / adjustability.
- She also provided some examples of projects to view as similar or providing benefit to the Galbreath development: The Point Reyes Field Station, The "Edible Schoolyard" at the Martin Luther King Middle School in Berkeley, The Ed Roberts Campus for accessibility at the Ashby Bart Station, and Asilomar, a conference center in Monterey that has many boardwalks connecting its facilities.

Ally provided us further information via email:

> I enjoyed meeting with you today regarding the Sonoma State research station. I hope that you have a chance to visit some of the sites I mentioned as examples. The US Access Board has a great document on Accessibility Guidelines for Outdoor Developed Areas.
>
> http://access-board.gov/outdoor/preamble.htm
>
> See also DSA's checklist, "Section 5- Official Comments (Checklist)," which distills the stricter of CBC or ADAAG on an issue-by-issue basis for educational use areas.
>
> http://www.dgs.ca.gov/dsa/Programs/progAccess/accessmanual.aspx
>
> CBC Chapter 11A applies to the staff residence.
>
> Best,

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PROJECT EXPECTATIONS

Introduction by RIM:

The project expectations have been provided by staff at SSU. This information was the basis of the program and will be used throughout the project to remain focused on the expectations for all involved.

Programs and Activities

The primary activities of the Galbreath Wildlands Preserve are education, research, management, and administration. Recreational use is not permitted. Preserve programs are most vibrant when these activities are integrated to the extent that it is difficult to categorize any activity as solely one category.

For this document, we break down these types of uses into the following logistical groupings. These groups tend to have the same kinds of needs when they are interacting with Preserve staff. Some of these groups on further consideration may be able to be combined.

I. All Visitors

II. Classes and Groups With Lead Instructor

III. Investigations in Science and Art (Research)

IV. Land Management and Monitoring Programs

V. Classes and Groups Without Lead Instructor

VI. Teacher Training

VII. Lectures, Retreats, Meetings, Workshops

VIII. Operations and Maintenance

IX. Tours and Events

I. Activities and Needs of All Visitors

- Information
  - Logistics
    - rules and regulations

- safety procedures and equipment
  - doc-in-a-box
  - cell phones and walkie talkies (communication on Preserve)
  - shelter in place?
- transportation
  - carpooling, public transportation options
  - clearly marked parking, unloading and convening locations
  - Idea: Virtual access from off-site: facility previews, data download

- Preserve Value
  - mission of Preserve
  - sustainability: function, design, and program features of facility
  - previous research, education, collaborations, management and activities on site
  - current visitors and on-going projects (who's active)
  - opportunities for further engagement in Preserve programs
- Region Specific / Activity-Related
  - how to get to specific environments on Preserve and in region
  - available data on local environments, economy, and culture
  - available research and education aids: teaching collections (?), library, lesson plans, etc.

- Arrival and Departure
  - sign-in / sign-out sheets (at front gate)
  - convening area for group arrival
  - check in / sign out with staff

- bathroom near arrival /departure location
- unloading and loading areas for food, recycling & garbage, field gear, overnight personal gear
- access to cleaning supplies and instructions in all areas used

- Communication
  - Staff Support (on-site staff act as information resource for everything)
  - Formal Areas
    - Audio visual equipment, internet access
    - Lecture seating and break out session seating
  - Informal Areas
    - place where group participants can unwind (e.g., volley ball, frisbee/football throwing area) and be noisy as they get to know each other
    - place where group can be quiet and reflect
- Living Logistics
  - Cooking, eating, sleeping, relaxing, working, exercise areas
  - Staying in touch with family and friends - internet, phones, etc.
  - Miscellaneous administrative supplies, tools they forgot
- Field Access
  - trails
  - 4-wheel drive vehicles and gasoline to access Preserve
  - directions to habitats in the region and support with logistics to obtain proper permits
  - virtual access to sensors on Preserve's sensor network

- Data Access
  - on-line
    - research publications and journals (campus library)
    - species lists, climate, GIS, etc. (Preserve databases)
  - on-site
    - library of field guides and local informational resources
    - scientific specimens teaching collection?

II. Classes and Groups with Lead Instructor

- Staff Lead: no
- Types of Programs: class field trips, resident courses, training and certification courses
- Participants: instructors with their students in university, extended ed, community and K-12 classes
- Duration: day use, weekends, extended stay
- Group Size: 6 - 30
- Specialized Needs:
  - Working space (often with dirty materials)
  - Shop with tools for students engaged in art projects
  - Display areas for student projects (posters, art, etc.)
  - Lecture area for instructor to talk to group; presentation area for students to present to group
  - Some:
    - lab space with access to electricity, water, gas, sensor network
    - ability to fabricate equipment
  - Outdoor Leadership: ropes course and other “permanent equipment”

III. Investigations in Science and Art (Research)

- Staff Lead: usually. no
- Types of Programs: independent endeavors in the liberal arts and sciences
- Participants: usually faculty, grad students, agency researchers, but also can include undergraduates, high-school students and community members (citizen science)
- Duration: weekends and extended stays
- Group Size: each project is usually 1 to 6 people; can include families on extended stays
- Specialized Needs:
  - Highly variable work hours; can include nocturnal research
  - Working Areas:
    - Fabrication of experimental equipment or art (art will require more long-term and multiple use needs for fabrication)
    - Bench/desk space for working
    - Bench/desk space (often restricted access) with easy access to electricity, water, gas, sensor network, cold storage
    - IT Engineering and Sustainability: easily accessed, changeable, upgradable IT sensor network components in the buildings and on the land
    - Observatory: high-band width data transmission, dark skies (location distant from other facilities), maintenance access, separate facility with local support buildings and utilities
  - Display areas: places to display art, research posters, photographs, and research descriptions
  - Storage to leave gear at site for up to a year
  - Temporary mudroom/storage areas to work with gear while on site (e.g., mammal traps, spot lights, water gear, etc.) outside until the following day
  - Access to long-term monitoring data on climate and water

- Relaxing Areas: visiting families need children-friendly locations
- Extended stays at more remote areas of the Preserve

IV. Land Management and Monitoring Programs

- Staff Lead: yes
- Types of Programs: invasive species control, exclusion fencing, pig eradication, riparian restoration, forest management, road maintenance, security patrol, monitoring, etc.
- Participants: staff, community members, K-12 students, university students, after school groups, faculty
- Duration: day use, weekends
- Group Size: 1 - 20
- Specialized Needs:
  - Access to standard tools, such as shovels, chainsaws, road drags, weed whackers, etc.
  - Ability to fabricate needed equipment
  - Area for large supply storage (e.g., fencing materials, signs)
  - Demonstration and orientation area where staff can talk to groups involved in management

V. Groups Without Lead Instructor

- Staff Lead: yes, often with docents
- Types of Programs: elementary school tours, after-school classes, university student group field trips
- Participants: trained docents leading K-12 students and community members; student groups
- Duration: usually day use, but can also be overnight
- Group Size: 6 - 30
- Specialized Needs:

- Gathering places where children can be easily supervised, let off steam, and will not disturb on-going work
- Orientation area where staff can talk to entire group

VI. Teacher Training

- Staff Lead: variable
- Types of Programs: docent training, and K-12 and university faculty teacher training
- Participants: community members, students, faculty
- Duration: day use, weekends, week
- Group Size: usually. 15-30
- Needs:
  - Visits to a diversity of habitats and research sites on Preserve
  - Access to props, tools and demonstration equipment (e.g., dip nets, microscopes, first aid packs, walkie-talkies, etc.), manuals
  - Up-to-date information on reserve visitors and projects

VII. Lectures, Retreats, Meetings, Workshops

- Staff Lead: variable
- Types of Programs: academic retreats, board meetings, lecture series, preserve meetings, regional workshops; interdisciplinary working groups;
- Participants: SSU faculty and staff, community members, educational organizations, agencies, and Preserves staff
- Duration: usually. day use, weekends, s. weeklong
- Group Size: 2 - 60
- Specialized Needs:
  - Chairs and tables for a variety of group working configurations
  - Storage for chairs and tables when not in use

- Capacity for catering staff
- Area for food set up that does not disrupt group

VIII. Operations and Maintenance

- Staff Lead: Yes
- Types of Programs: security, meet & greet, facility maintenance, administration, land management, security, safety, community partnerships, educational programs, recycling, utilities etc.
- Duration: year round, day use, overnight
- Participants: Preserve staff, SSU facilities and administrative staff, family of resident staff; student and community interns and volunteers
- Group Size: usually 1 – 3; family of 4
- Specialized Needs:
  - Emergency response vehicles (fire truck turn around)
  - Carpentry and plumbing tools (minor repairs)
  - Administrative office with ability to monitor ingress and egress
  - Internet access
  - Storage area for supplies (administrative, cleaning, hardware supplies, toilet paper, etc.) for visitors
  - Equipment and vehicle check out area
  - Fee collection
  - Residency for on-site staff
    - Yard area for children, pets, and garden
    - Privacy from other visitors
    - Ability to monitor visitor ingress and egress
  - Sales of Preserve paraphernalia and products (Art and Business collaboration in sales) to promote Preserve

IX. Tours & Events

- Staff Lead: usually. Yes
- Types of Programs: demonstration projects, public tours of lands and research, open house; fundraising events
- Duration: day use
- Participants: everyone
- Group Size: 2 – 150
- Specialized Needs:
  - Information about how they can participate
  - Presentation, poster areas
  - Vehicle coordination and front gate information

Introduction by RIM:

The project Vision, Goals and Ideas were provided by staff at SSU. This information will be used as the basis for all decisions made during the project and evaluated to be sure the end result will clearly define the Vision of SSU and their commitment to the Galbreath family and the community.

Vision, Goals and Ideas

This document is compilation of ideas from Preserve staff, SSU faculty, students and staff, and community members. Ideas from campus and community members were gathered at two 2-hour charettes hosted on the SSU campus on June 1, 2011 and at Ravenridge in Yorkville on June 8, 2011. Ideas gathered were organized into the following areas:

Vision

Accessible facilities that inspire inter-disciplinary investigation, study, and learning in the liberal arts and sciences about California's North Coast.

Goals

Program	Develop spaces that make the education and research facility easy to operate and meet changing demands of diverse visitors
Experience	Create environments that enhance diverse social interactions and emotional responses needed to create vibrant interdisciplinary programs
Sustainability	Produce a robust design that uses minimal energy and minimizes effects on ecological processes; adopt sustainability decision-making process for planning, construction, operation and maintenance
Technology	Create facilities that are easily manipulated to incorporate IT technology that enhance learning and study about other goals
Do-Ability	Create designs that support permitting and constructing the field station

Additional goals include quality, cost and scheduling.

PROGRAM GOALS - DEVELOP SPACES THAT MAKE THE EDUCATION AND RESEARCH FACILITY EASY TO OPERATE AND MEET CHANGING DEMANDS OF DIVERSE VISITORS

- Facilities and services make it easy to undertake field learning and study
    - Preserve habitat are easy to get to and study
        - 4-wheel drive ATVs
        - pop up trailers can be are mouse proof
    - Food preparation and other activities are quick and easy
    - Facilities are clean and functional
    - Expectations for visitor use is clear and easy to accomplish
- Easily used by groups of different sizes from all disciplines
    - Facilities can responds to changing areas of interest over the next 200 years
    - Sleeping configurations conducive to groups of 1 to 30 (classes)
    - Every space can be modified to accommodate
        - needs of any discipline (researcher or artist)
        - variety of interests within disciplines
            - modular and repeating hookups for utilities in work spaces and laboratories
    - Specialized facilities are available to engage targeted disciplines (i.e., telescope, outdoor leadership)
- Low maintenance materials and designs
    - No annual painting, staining, etc.
    - Materials that develop desirable patinas from visitor use – especially is high use areas
    - Unbreakable beds, tables, chairs, etc. (built in?)

- Designs that prevent rodent, bear and pig damage
  - Vehicles are in mouse-proof areas
  - Composting
  - Food storage
  - Garbage
- Bathrooms
  - can be washed with a hose
  - easily cleaned surfaces
  - carefully designed splash zones and soap dispensing
- Repairs require little time
  - Utilities are all easily accessible (e.g., external channels for wiring)

EXPERIENTIAL GOALS - CREATE ENVIRONMENTS THAT ENHANCE DIVERSE SOCIAL INTERACTIONS AND EMOTIONAL RESPONSES NEEDED TO CREATE VIBRANT INTERDISCIPLINARY PROGRAMS

- Connections among people, especially those that generate diverse, new experiences
  - identified social/gathering areas with attractants that draw people to them
    - one main area with gradient of social opportunities for engagement or observation by participants; multiple small areas for more private interactions
    - "human scale" views and inspiring vistas
    - spaces conducive to talking
      - good acoustics
      - soft ambient light
      - comfortable seating
      - separate places for noisy interactions and quiet interactions

- comfortable temperatures

- elements that attract people
  - fire
  - food (coffee, beer, wine)
  - comfort: comfy chairs, hot tub
- spaces that feel intimate for 2 and spacious for 60 people
  - square tables that can be easily pulled into any seating configuration

- visitors aware of each other's presence
  - natural movement pathways (arrival area, trails, etc.) are recognized for their potential for people to stop and talk ("hallway moments")
  - places where people "linger" (i.e., work spaces, labs, shops, dining) visible to others (but still allow people to work without disturbance)
  - "leave behinds" - previous visits are documented (e.g., journal kept in lobby or common room; class plaques; chalkboards)
  - visual identification of interests of persons on site - "oh, there's a seismologist here! I need to talk to her."

- Connections between people and place – environment, not buildings, are the focus
  - minimize visibility of facilities
    - rooflines fit with landscape,
    - natural shapes and designs (curves)
  - make learning about place central to visitors' experience
    - facility designs teach about natural and historic environment
    - incorporate architectural elements that evoke history of environment, culture, economy
    - use on-site materials

- welcoming environment starts at the front gate and continues to the facilities
- videos of oral history for viewing by guests

- facilities increase awareness of the environment
  - indoor spaces draw people outside
    - "soft edges" on the buildings: windows and doors are areas for hanging out; porches provide partial shelter areas
    - functional elements of the room continue outside the windows (e.g., kitchen counters, seating areas, etc.)
    - indoor areas are opportunities for observing outdoors (changing sound, light, temperature, wind, rain, sun, moon, stars)
  - natural aesthetic
    - use of natural materials (rock, wood, metal, glass)
    - retain a sense of remoteness
    - retain sense of respect for the land and organisms
  - facilities enhance observations of astronomical changes (sun, moon, stars): 'structures' that track motions (seasonal, daily, eclipses) of sun and moon using shadows
    - experiences of darkness, extremes in weather (cold/wet winter. hot/dry in summers) and contrasting comfortable spaces fireplace, shade, etc. that remove or reduce uncomfortable elements (seasonal mosquito blitz, rodents, cold, heat)
- communicate value and purpose of SSU Preserves
  - design features that demonstrate art-science interdisciplinary approaches
    - Fibonacci series as part of architecture
    - Architectural features that document celestial changes in sun, moon and stars
  - places to present stories of impact. How does this preserve/field station improve

lives, educate students, make the world a better place

- Inspire creativity and exploration
    - design features that are themselves creative
        - make users aware of sun's seasonal movement and moon phase (mirrors the presence of the on-site observatory)
        - incorporate the golden ratio or other math/nature ratios (e.g, Fibonacci series in pine cones)
        - use reclaimed objects with new functional use, areas for displaying art
        - labyrinth designs in patio
    - architecture that changes visitors' perception of the world
        - canopy viewing, subsoil viewing, data visualization
    - places for visitors to share creativity
        - exhibit areas (indoor and outdoor) for people to share creativity in art, science, history
        - journal kept in the lobby or common room or place; inspired poetry or thoughts
    - give people a chance to discover
        - trails that lead from facilities to diverse habitats and views
        - nooks
    - good sleeping environments
        - needs of nocturnal researchers
        - snorers
    - comfortable
        - mosquito proof areas during mosquito month
- Teach visitors about themselves

- provide feedback on available and used energy, light, to users and visitors
- learn to overcome fears of wilderness (snakes, scorpions, poison oak, mountain lions) teach self-reliance: limited to what you can pack in and out
- nature survival – living with nature

- Accessible and Safe
  - 2-wheel drive vehicles need to be able to reach the field station year-round
  - ADA compliant
  - access for emergency response vehicles
  - fire-safe compliant
    - enclosed hearth for outdoor fires with spark arrestor
  - rodent and mosquito-proof (due to disease transmission); tick information
  - not a bear attractant

SUSTAINABILITY GOALS - PRODUCE A ROBUST DESIGN THAT USES MINIMAL ENERGY AND MINIMIZES EFFECTS ON ECOLOGICAL PROCESSES; ADOPT SUSTAINABILITY DECISION-MAKING PROCESS FOR PLANNING, CONSTRUCTION, OPERATION AND MAINTENANCE

- Clearly adopted goals in sustainable building and practices
  - Platinum LEED (Note: LEED Silver is institutional bottom line). Consider Net Zero Energy Construction (or Plus Energy), Carbon Neutral, Passive Haus, Living Building Challenge
  - Create goals for energy use and production measurements (e.g., Jasper Ridge Biological Preserve's Leslie Shao-ming Sun Field Station http://jrbp.stanford.edu/fieldstation.php).
  - Adopt a sustainability decision-making process for field station planning, permitting, construction, maintenance and operation such that all decisions take into account environmental, social and economic variables
    - use local workforce – adopt local employment practices
    - create financial models for earned revenue

- Heating & Cooling
    - passive solar
    - abundant local downed wood used for heating and burned in cleanest manner possible
    - counter current options with fireplace, plumbing, computers
    - consider underground rooms, especially for cool food storage
    - consider underground pipes for cooling system
- Small Size - minimize building footprint
    - flexible and transforming spaces; every space can be used for something else
        - use areas above cars in parking lot for solar panels
        - bed configurations are flexible allowing for occupation by individuals, couple, or family (e.g., Murphy beds)
    - outdoor spaces wherever possible
    - well-designed hooks and shelving that minimize spaces needed for bathing, sleeping
- Electricity
    - solar and wind power
    - green lighting
    - use on-site materials: salvage Douglas fir and other trees for use in facility construction; tan oak should be harvested due to sudden oak death
    - steam from fire
    - stored water can be used for power generation
- Water Use and Processing
    - rainwater catchment to reduce effects of water use on ponds and springs
    - composting toilets
    - grey water systems

- water use meters

- Waste
  - facility design identifies waste flow paths
  - designated pick up areas for staff to bring waste to proper facilities
- Construction Materials
  - use local materials
  - recycled materials
  - minimize materials needed by reducing size of facilities
  - modular green units
  - construction containers for storage areas
  - portable buildings, rolling buildings
  - cob houses – build in collaboration with Emerald Earth (in Philo)
  - yurts, tent cabins for initial structures
- Transportation – large source of carbon
  - orientation tours can be made virtual
  - virtual visits
  - carpooling
    - undersize parking lot to encourage carpooling
  - travel by SMART to Cloverdale
- Maintain value of lands for research and education
  - measure effects of field station construction and human occupation on surrounding environment
    - temperature, light, water levels, car exhaust, animal movements, etc.

        - start collecting data now to understand impact information
    - preserve or improve conditions of ponds and springs
    - prevent arrival and movements of exotic species on Preserve
        - tire wash road dip
        - landscape with native and edible plants
    - minimize effects of light and noise pollution
        - keep in mind that windows create light pollution on surrounding landscape at night
    - do not change behavior or population sizes of local species (e.g., bears, rodents)
    - minimize erosion on trails and roads

IT TECHNOLOGY GOALS - CREATE FACILITIES THAT ARE EASILY MANIPULATED TO INCORPORATE IT TECHNOLOGY THAT ENHANCE LEARNING AND STUDY ABOUT OTHER GOALS

- Facilities serve as a sensor and communications education and research laboratory
    - Environmental Sensor Networks
        - weather and hydrological stations
            - weather station
            - Weather hub with subfocus for grape growers
        - air quality monitoring station proposed by Sonoma technology for a “zero point” reference
        - seismometers, tilt meters
        - cameras
    - Smart-Building Technologies
        - building design features that make sensors and equipment easy to install and modify

        - building-human communication sites
        - allow analysis of building performance (e.g., Leslie Shao-ming Field Station)
        - compared to Environmental Technology Center compared to Galbreath Wildlands Preserve.
        - ways to measure waste produced

- Use IT technology to enhance other goals
    - Sustainability
        - Travel: virtual visits at virtual observatory on campus
        - Establish sensors that track
            - energy systems of the buildings
            - potential environments impacted by buildings (e.g., water in ponds, noise pollution, light pollution, nitrogen deposition along roads, etc.
            - energy produced by diverse sources: wind, solar, hydro, steam from fire
        - Create ways to provide visitors with
            - estimates of the amount of energy used / saved during their visit
            - goals for energy use
            - information needed to make immediate decisions about energy use (e.g., water meters, battery bank charging)
            - Offer people a chance to monitor their activities through Fitbit.com
        - Create ways for buildings to make decisions or provide information about
            - maximizing comfort for visitors
            - conserving stored energy
            - maximizing efficiency of system (e.g., self-monitoring maintenance reports)
    - Experience

- Connect With Place: create visitor options for no cell phone and no internet coverage
- Connect With People: create software that shares images of visits by other people

DO-ABILITY GOALS - CREATE DESIGNS THAT SUPPORT PERMITTING AND CONSTRUCTING THE FIELD STATION

- Designs acknowledge funding opportunities
  - Initial construction provides exceptional visitor experience that engenders more funding
  - Buildings that are difficult to fund are identified with cost-effective options
    - caretaker residence can be purchased as modular home
    - garage can be built from used shipping containers (can be built off-site for specific uses)
  - Modular and repeating designs (e.g., cabins) can be built with funding as available (can also provide naming opportunities for donors)
  - Post and beam construction can allow for phased construction
- Compatible with local community
  - Site all facilities so that they are not visible from surrounding homes
  - Identify methods to reduce traffic on Elkhorn Road

Galbreath Wildlands Preserve Field Station Planning
SSU Field Stations & Nature Preserves
Facility Spaces

Functional Space	Capacity	Functional Description	Possible Other Uses
Vehicle Areas			
Parking	for 45 cars	parking for passenger vehicles and vans; is parking needed near entrance for events?	solar panels
Loading and Unloading	for 1 car	vehicles can drive up to kitchen, sleeping areas, storage areas, garage, and fireplace to load/unload supplies	mudroom
Garage	4 ATVs	mouse-proof garage for Preserve vehicles; safety storage for storing gasoline; car repair area	long-term storage
Kitchen			
Cooking	4 groups simultaneously	communal cooking stations with all necessary equipment for personal, group cooking and catering; include communal dishwashing site for diners	social gathering area (everybody always ends up here)
Food Storage	food for one week for group of 30	easily designated/separated cold and dry storage for multiple groups	
Equipment Storage	4 groups simultaneously	pots and pans for groups of 1 to 60; easily visible and accessible	
Serving	up to 60	easily served to inside and outside dining areas	serves break and snack areas
Waste			
Composting, Recycling, Garbage		waste stream separation; bear, pig and mouse proofing; methods for measuring waste produced	landscaping and small food garden; art works surrounding waste production
Eating			
Dining Area	up to 45	immediately adjacent to, or part of kitchen	meeting area or classroom
Outside Dining	up to 60		meeting area or outside classroom
Snack Area		location for visitors to sit, share coffee, tea on a break; easily accessible and serviceable from kitchen	meeting area
Break Area	up to 60 people standing up	morning and afternoon coffee break area for meetings and workshops; drinks during meetings; easily serviceable from kitchen	hallway
Communication and Relaxation Areas			
Central Meeting Area	up to 60 people	central location that attracts visitors due to its beauty, comfort, food, fire, etc; provides gradient of engagement to observation	
Other Meeting Areas	4-5 areas with capacity of 4 to 15 people	seating areas of various sizes that allow for observation, reflection and quiet conversation	
Active Noisy Area (Outdoor)	up to 30 people	area for relaxation and exercise; space for throwing balls and frisbees; and group sport participation (i.e., volleyball)	
Exhibit Areas		spaces for sharing information and creativity; art gallery place for people to share art and research results sculpture garden	
Bathrooms			
Showers		separate showers for men and women; low water use; personal and communal options; water use tracking	
Toilets		composting, not stinky, easy to clean, easy to unload compost	
Sinks		low maintenance designs; low water use; water use tracking	
Sleeping Areas			
Beds / Cabins	60 beds broken into sleeping areas of 1 to 8 people	comfortable protected sleeping locations that provide a good nights sleep; within easy walking distance of bathrooms and showers	meeting rooms, study areas, family living room, artist workshop
Camping			
Tent Sites	up to 30 people	tent sites or camping platforms for groups that prefer camping; maintains a low or no-cost overnight option; can be used as Phase I lodging; needs to be near bathrooms, showers, toilets	
Cooking	up to 30 people	water; tables for food preparation; grill; place to wash dishes; place to store food coolers; propane	
Dining	up to 30 people	picnic tables	
Mobile Campsite	up to 2 remote camping groups	Place to store a trailer unit that includes bathroom, kitchen facilities for camping on other areas of the Preserve; mostly for use by researchers and land management groups; pop up trailer	
Composting, Recycling, Garbage		bear and mouse-proof areas for storing garbage	same as areas for main facilities
Staff Residence			
Home	4-person family	family residence situated to easily notice vehicles entering and leaving Preserve while also maintaining privacy.	
Yard	4-person family	designated private outdoor area	
Parking	2 vehicles	personal vehicle parking	

Galbreath Wildlands Preserve Field Station Planning
SSU Field Stations & Nature Preserves
Facility Spaces

Teaching, Research, Working Areas			
Meeting Room (Indoor)	up to 60	indoor meeting room for up to 60 people working in break out groups (i.e., 10 tables) with A/V and internet	classroom, dry lab
Amphitheater (Outdoor)	up to 60	gathering place for arriving groups; outdoor presentation areas for teachers, student presentations	
Classroom	up to 40	area for teaching with A/V equipment capacity	
Dry Lab		work spaces for working with "dirty" materials or studying (no utilities needed)	classroom, meeting room
"Wet" Lab		modular bench spaces with access to suite of commonly used utilities (water, electricity, sensor hookups, gas lines, septic system)	
Shop	class? 2 people?	area with equipment for fabricating field equipment, art, and with tools for light maintenance; what kind of tools should we use?	artist work spaces
Library	2 walls of shelf space; seating for 4	field guides and resources unique to local area; copies of publications and reports conducted at Preserve; check out area; place to sit and read books	informal meeting area, relaxation; could be part of hallway
Teaching Collections??	???	plants, animals, rock specimens that support learning about identification; usually needs cool constant temperatures and no light	
Bone Yard	n/a	outdoor storage; area hidden from view that allows staff to store materials and supplies (e.g., wood, fencing materials, reclaimed objects) for future use	resource for artists
Long-term Storage		lockable lockers that provide space for researchers to leave equipment for use next season	garage
Daily Storage and Mud Room		porch area adjacent to kitchen and other indoor use areas for temporarily dropping off equipment, packs, etc. when returning from field	
Equipment Room		equipment and vehicles regularly used by docents and others that can be checked out and tracked by staff	
Greeting and Administrative Areas			
Front Gate		easily usable; best location for tracking use of the Preserve; information for passers by	
Bridges		first facilities viewed; should be compatible with facility design	
Information Hub	viewing by groups	provides logistical, place-based, preserve information for all visitors; may include computer displays	sales
Office	2 staff members, summer interns, docents, volunteers	working area for staff, interns, volunteers (e.g., check-in, administrative supplies for visitors, data entry, etc.); place for visitors to find staff; check out equipment; check in etc.allows staff to act as logistic resource for groups; check out equipment; know if someone is arriving; enforce rules and regulations; work with volunteers and interns	
Sales		designated location to display products made available by business and art students	
IT Technology			
Data Transmission		equipment and utilities needed to establish high-band width capabilities for observatory, sensor network, etc.	
Sensor Network Center		central hub for computer and telecommuncation equipment needed for data transmission from sensors located on the Preserve and in surrounding facilities; establishes the field station as an experimental laboratory for research in sensor development, telecommunication, and software development by students and faculty;	
Cell Phone		booster needed; coverage provided for safety reasons; can be shut off when requested	
Trails and Walkways			
Trails		among facilities and from facilities to other places on Preserve; some self-guided (interpretive trails	
Walkways		designed to bring people into contact and to provide remote experiences in nature; stopping areas for talking; bring people to areas where they can see what other people are doing	
Specialized Facilities			
Outdoor Leadership		areas to install a high ropes course; zip line; other	
Exploration and Canopy Research		canopy bridges; raised decks under large madrones; labyrinth; Fibonacci series; astronomical design	
Observatory			
Telescope		Telescope enables multi-disciplinary interactions with astronomers and enhances possibilities for adaptive optics collaborations.	
Support Buildings		Provides storage and equipment needed to run telescope	
Utilities		separate solar or wind for operation of telescope	

OBSERVATORY INFORMATION Provided by: Scott Severson of SSU on May 10, 2011

The baseline observatory design is a set of two modular buildings, a telescope dome and a science support building.

While there is no formal agreement at this time, a strong possibility and a good baseline design is that of the 1-m telescope + enclosure + science_support_building of lcogt.net Here is a link to the test assembly of the largest building the 18.5' diameter observatory:

http://lcogt.net/en/blog/dpetry/lcogt-ceo-wayne-rosing-builds-1-meter-enclosure

The wall sections and such are modular and assembled on site. the largest single piece is the 18.5' diameter dome structure that tops the building. Drawings are available at:

http://www.ashdome.com/

The science support building: SSB is basically a shipping container that contains the requisite electronics and support for the observatory. Details about it are available in the pdf I have attached to this email. (Note we would have a setup with a single dome and a single SSB, not the larger site layout shown in Figure 2 of the pdf.) This paper is probably exactly what you need to begin your analysis as it discusses site preparation, foundation requirements, shipping considerations and the like. By my rough estimate the SSB is 20'x8'.

Additional requirements we would have would be power generation and storage. Whether that is at the field station or local to the observatory I am unaware.

It is possible to envision a helicopter delivery of these parts to the observatory site. (As per LCOGT founder Wayne Rosing).

Q&A between RIM and SSU:

- How do you envision the Observatory being used? Would staff be present at this location at all times? Would anybody sleep at this facility?
    - These questions are more about the hazards incurred in the structure. If the rate of occupancy of the building is low, it may be exempt from requiring access roads for fire or emergency vehicles, and may just have a well-built pedestrian walk to the facility.

It will be used mostly robotically and remotely. I envision that should we have 24hr/day presence within the preserve that the site will be visited once per day as part of a daily inspection. Then I envision that more advance technical support presence is required on an approximately weekly or b-weekly basis, often a single person or a pair of people. There will be no sleeping at the site, but at the beginning there will be periods of time of all-night operation locally (sleeping at the nearby field station) as the system is configured for long-time operation. These would last for a couple of days and would subside once the system is operating remotely. The only larger scale visit (more than say 3-4 persons for a few hours) that I could envision is bringing a larger group there as part of a tour. (This is by no means a requirement, but a walking path where a dozen or two people could come and visit the site would be desirable.

LCOGT Sites and Facilities

John J. Martinez*, Timothy M. Brown, Patrick Conway, Mark Elphick, Michael Falarski, Eric Hawkins, Wayne Rosing, John Shobbrook, Las Cumbres Observatory Global Telescope Network (6740 Cortona Dr., Suite 102, Goleta, CA 93117, United States)

ABSTRACT

LCOGT is currently building and deploying a world-wide network of at least twelve 1-meter and twenty-four 0.4-meter telescopes to as many as 4 sites in the Southern hemisphere (Chile, South Africa, Eastern Australia) and 4 in the Northern hemisphere (Hawaii, West Texas, Canary Islands). Our deployment and operations model emphasizes modularity and interchangeability of major components, maintenance and troubleshooting personnel who are local to the site, and autonomy of operation. We plan to ship, install, and spare large units (in many cases entire telescopes), with minimal assembly on site.

Keywords: Network, world-wide, modularity, autonomous, interchangeability

1. INTRODUCTION

Building and deploying a globally distributed network of astronomical observatories is a daunting engineering and logistical challenge. Adding to this complexity is the fact that each of our sites will consist of multiple enclosures, telescopes, and support facilities. Among the many concerns that need to be addressed are: existing site infrastructure, varying site characteristics (topography, soils, utility/electrical grid standards, etc.), managing within a limited available footprint, and producing reliable facilities and equipment that have the long mean-time-between-failures required for a truly robotic and autonomous network of observatories.

To efficiently manage these concerns, LCOGT developed a "standard model" of facility design and site layout that enables us to fabricate most components at our company headquarters located in Southern California, where strict engineering and manufacturing control is more easily applied. Our telescope and observatory enclosure designs use a modular approach which allows minimal disassembly into manageable subassemblies for shipping, but also facilitate rapid reassembly on site with minimal decision making during the deployment process. This approach minimizes reliance on differing contractors for construction and deployment, allowing for a greater degree of "as-built" uniformity across all network sites.

Fabrication of telescopes, instrumentation, and electronic control panels all follow the same standard model approach, allowing for easy interchangeability of standard components that are identified as more likely to fail. This in turn reduces maintenance to a relatively simple matter of swapping out a failed module with an on-site stocked spare part, ensuring that the "up time" of that particular network node, as well as the continuity of the global network, is maximized.

2. THE GLOBAL NETWORK

2.1 LCOGT mission

The general mission of the Las Cumbres Observatory Global Telescope network (LCOGT) is to establish a durable scientific institution dedicated to time-domain astrophysics. LCOGT has primarily a scientific directive, but an educational component as well. The more specific scientific focus is discovery/characterization of extra-solar planets, active galactic nuclei, and stellar oscillations/variable stars. The educational component is directed at inspiring critical thinking and technical understanding in young people through collaborations with professional astronomers.

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2.2 Site selection criteria

Achieving our scientific mission requires the development of specialized facilities and equipment, along with deployment to selected locations around the globe. By carefully selecting site locations distributed longitudinally, one or more nodes of the global network will always be in dark skies, allowing for continuous data collection of transient events.

There are several other factors besides longitude that drive our site selections. 1) Astronomical considerations: Obviously atmospheric seeing conditions must be generally arc-second or better, and the fraction of available clear Moonless nights must be high. The sites should be of relatively high altitude to be above local marine layers and/or inversion layers. Also, the separation of the North and South network rings from the equator should be sufficient to allow excellent declination coverage of the sky with generous overlap, especially of the Milky Way bulge. 2) Pre-existing infrastructure: Because of our need to keep costs down and timelines reasonable, establishing infrastructure from scratch at multiple remote locations is impractical. Therefore the only sites under consideration are those that have, at a minimum, power, communications, and reasonable transportation access already in place. 3) Political stability: Although our facilities are generally considered to be autonomous, we do realize that personnel will need to visit each network node several times throughout its life cycle, and personal safety is a serious matter. Therefore countries undergoing severe political unrest or otherwise represent a dangerous environment are not considered, regardless of their other qualifications.

2.3 Chosen network node distribution

Six sites have so far been identified as prospective network nodes. Two of the sites (Hawaii and Eastern Australia) already have 2.0-meter telescopes operational (Faulkes Telescope North and South, respectively), and 2 sites (Chile and South Africa) have all civil work completed and are awaiting the start of our standard facility installation to accommodate a cluster of 1.0-meter and 0.4-meter telescopes. Other sites are in various stages of negotiation, site planning, or groundbreaking.

Table 1. The six known LCOGT northern and southern ring network node locations, listed west and east of Greenwich, respectively.

Site Designation	Latitude, Longitude, Altitude	Location
TFN	28.133650° N, 16.511619° W, 2390m	TO, Tenerife, Canary Islands, Spain
ELP	30.680072° N, 104.014883° W, 2029m	McDonald Obs., UT, Texas, USA
OOG	20.707058° N, 156.257375° W, 3034m	HO, IFA, UH, Maui, HI Islands, USA
LSC	30.167500° S, 70.805000° W, 2153m	CTIO, La Serena, Chile
CPT	32.380694° S, 20.809797° E, 1759m	SAAO, Sutherland, South Africa
COJ	31.271767° S, 149.061692° E, 1144m	SSO, ANU, Siding Spring, Australia

The average network node latitude is approximately +/- 31 degrees of the equator, with a maximum of 32 degrees and a minimum of 21 degrees. In addition to these six, we are investigating possible sites in Asia and Western Australia.

In some cases compromise was necessary in order to fill longitudinal gaps in the network ring. For example, a conceivable Asian site would be Urumqi, China which is not optimal because of its more northerly latitude and lower clear fraction of observing nights. This is a case in which longitudinal coverage is deemed more important for maintaining continuity of the network.

A map representation of the entire LCOGT global network can be seen in Figure 1.

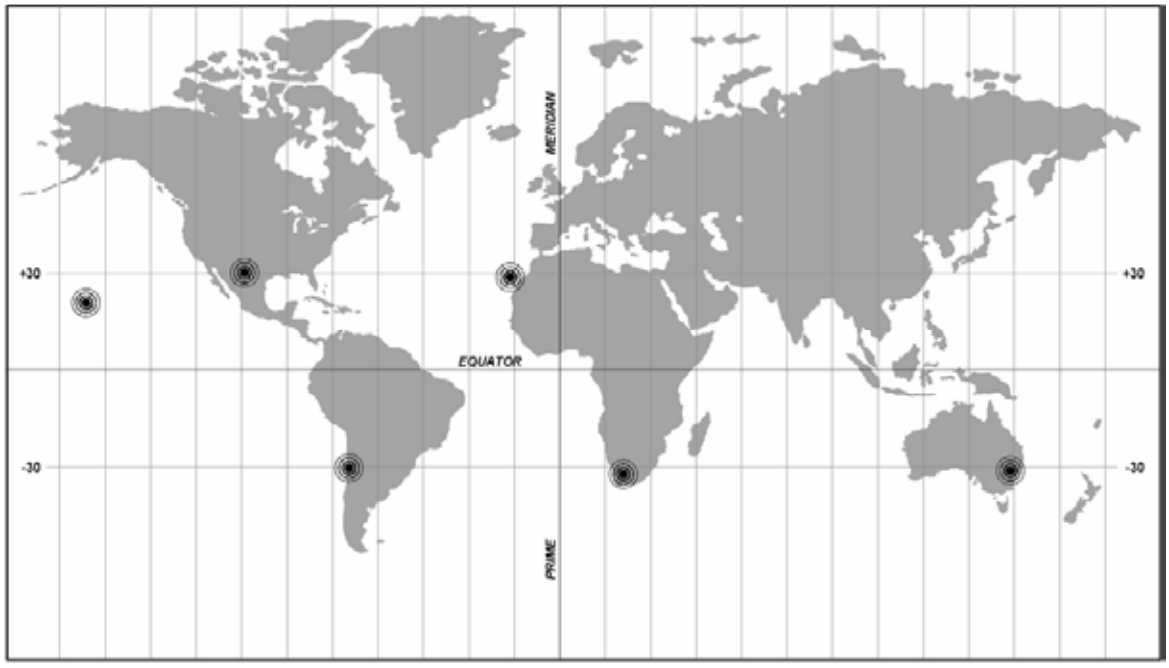


Figure 1. A world map showing all the known LCOGT network nodes in various latitude and longitude positions.

3. SITE DESIGN AND CIVIL WORK

3.1 Site layout considerations

All of our sites are designed to be relatively compact and efficient arrangement to accommodate three 1.0m telescope enclosures, three 0.4m telescope clamshell enclosures called Aqawans (Chumash for "to keep dry"), a site services building (SSB), a weather station tower and a storage building.

The minimum footprint of the site is determined by zenith-angle (Z-angle) analysis. Our requirement is that the maximum zenith angle clearance required for all telescopes on site is 75 degrees, or the equivalent of about 4 air masses. To accomplish this requirement while covering the smallest practical footprint, an equilateral triangle arrangement was adopted. Each side of the triangle measures about 14 meters, which provides just enough space to position the SSB and weather station tower near the center of the layout without interfering with the observatories. The triangle's orientation varies somewhat from site to site depending on local landscape, but if possible is arranged to take best advantage of prevailing weather patterns and laminar air flow.

The Aqawan cluster must be placed at least 20 meters from the 1.0m cluster to honor our Z-angle restriction, because the 1.0m telescope enclosures are nearly 2.5 times taller than the Aqawans. Likewise, our weather station tower is limited to a height of 5 meters so that it remains invisible to the 1.0m telescopes that surround it. The tower is attached to the SSB so that cumbersome guy wires can be eliminated from the site. The generous spacing between the 1.0m telescope cluster and the 0.4m telescope cluster permit easy ingress and egress by site vehicles, including forklifts, cranes, and other equipment that may be needed for installation and assembly, or maintenance/replacement of larger components.

We also have one permanent storage container (8' x 20') on site for storing tools and spare parts, rigging, CO_2 bottles for cleaning optics, and other miscellaneous items.

Figure 2 illustrates the main elements and arrangement of various facilities at a typical observatory site, including the equilateral dome layout. The outer dashed circle represents the open swing radius of the lower shutter door on the 1.0m

telescope domes, and the dashed rectangle represents the extent of the opened clamshell roof of the Aqawans. Note that each Aqawan enclosure houses 2 of the 0.4m telescopes (represented by the light gray circles in this schematic).

The SSB serves as central services for the site, distributing UPS power, utility power, and fiber communication to all telescope enclosures and to the weather station, via underground conduit.

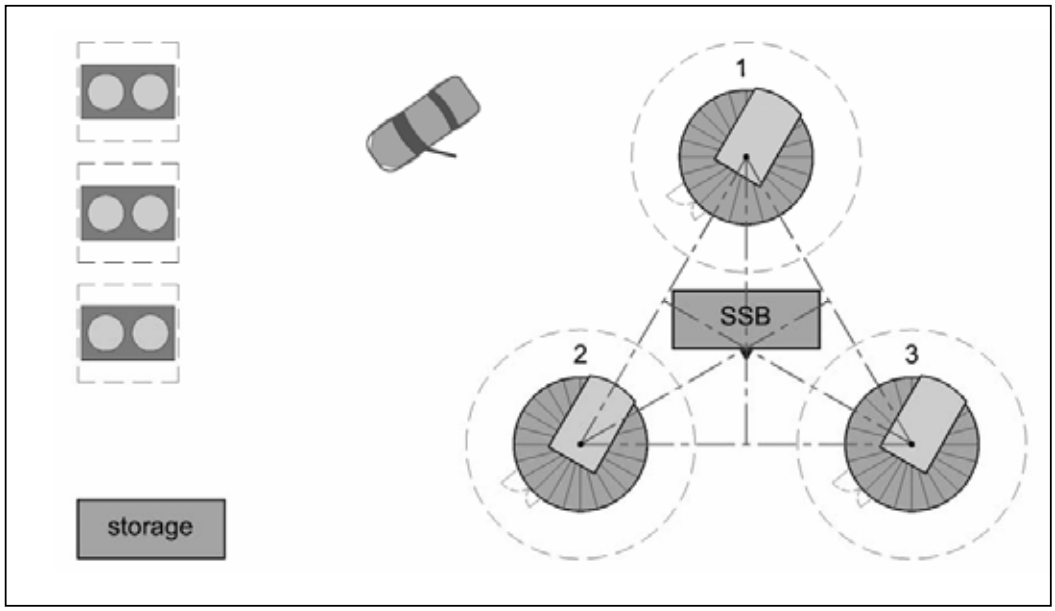


Figure 2. A typical site layout. Automobile shown for scale.

An added advantage of the standard model method of site design and layout is that, barring unusual site constraints, it allows development of relatively predictable costs and timelines for site readiness.

3.2 Site preparations

Most sites require a bit of earthwork before construction can begin. In general we require that soils beneath our foundations are compactable to at least 95%, and that the building pads be reasonably flat. At some sites drastic measures are required to properly prepare the site. In the case of CTIO, for example, our site location is on a rocky slope, requiring that hundreds of cubic meters of prepared fill be built up into a level pad. Once the soil pads are properly prepared, a true north-south line is established, and laying the foundations can begin.

3.3 Foundation requirements

All concrete foundation designs are certified by a civil/structural engineer to ensure that safety and longevity requirements are met, as well as international building codes. Our requirement is that all buildings/foundations be rated to endure earthquake shaking likely encountered in seismic zone IV, and wind loading from 150kph storms. For our 1.0m telescope, the concrete pier is extended down to, and keyed into, bedrock. The piers are engineered to have high resonant frequencies so that they will not excite from wind loading or the fast slew motions of the telescope mounting. Telescope piers are isolated from building foundations by a 25mm foam gap to reduce dome motion vibrations and building wind loading forces transmitted to the telescope, and aligned north-south to within one degree of the pole.

Concrete slabs for the smaller Aqawan enclosures are monolithic and do not contain separate isolated piers for the two 0.4m telescopes. Since the clamshell design of the Aqawan requires that the roof open only once and not move during the night, separate pier isolation was deemed unnecessary.

To ensure that concrete slabs are not compromised in any way, all concrete foundations contain NO penetrations for conduit. All services are brought into the telescope enclosures from trenches that terminate at the foundation edge, then

rise up and penetrate directly into the side wall of each facility. Also, since our enclosure walls are engineered to a standard model configuration in advance of site work, no anchor bolts are installed into wet concrete at site. Wet laid anchors invariably get placed at inconvenient or even inappropriate locations, and/or are not plumb. Therefore all concrete anchors for securing walls are drilled and epoxied in place after wall erection, ensuring that their placement perfectly matches what is needed by our pre-fabricated wall modules.

Finally, after the foundations have cured for at least 2 weeks, they are coated with an anti-static paint.

3.4 Electrical distribution, grounding, and lightning protection

Distributing UPS power, utility power, communication fiber, and grounding protection from the SSB to 6 different telescopes on site is no trivial matter. To accomplish this we use an organized system of half-meter deep trenches containing PVC conduit that carries all services connecting all facilities.

To minimize quantity and complexity, we use just one large conduit between the SSB and each building, and this conduit carries all services. Buried at the bottom of each trench is a 15mm stranded copper wire that connects all foundations, buildings, domes, and control panels back to the SSB main grounding bus bar. This bar is solid copper, 100mm wide by 6mm thick, by 3 meters long, and tin plated for corrosion protection. All the SSB's internal control panels ground to this bar, and the bar itself is grounded to the trench-buried stranded copper "ring" running throughout the site by the two copper grounding wires (shown in Figure 3) extending downward at either end of the bus bar. This system should provide adequate protection from transients and lightning strikes.

The SSB wire trough, essentially a weather tight galvanized box measuring 25cm x 25cm x 3m, provides the gateway between the site services building control systems and the various facilities scattered throughout the site. All services, whether power, fiber, grounding, or even compressed air, pass through this trough. Figure 3 below illustrates the various arrangements of components into and out of the SSB wire trough. The five holes indicate penetration into the outside wall of the SSB.

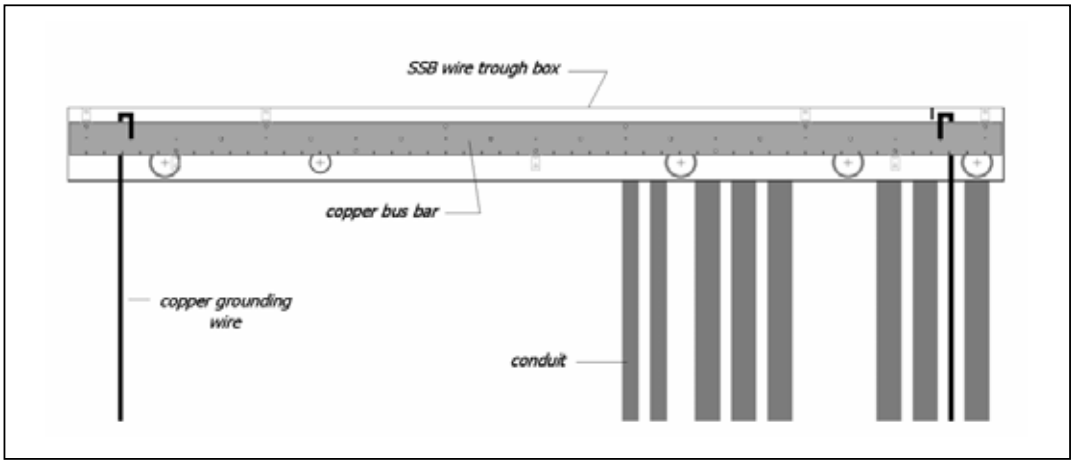


Figure 3. A typical SSB wire trough "standard model" layout. Cross-section with major components labeled.

All distribution from within the SSB to the outside world occurs through the five hole penetrations shown. Holes from left to right are: communication fiber out; spectrograph fiber in (from telescope); UPS power out; utility power out; and utility (site) power incoming. A single disconnect breaker switch is positioned near the incoming utility power, and tripping this switch powers down the entire observatory complex.

Conduit drops from left to right are: compressed air in; services out to weather station tower; services out to Aqawan cluster; services out to dome A; services out to dome B; services out to dome C; services out to dome D; and site utility services (power and fiber) incoming. There is also room for an extra 75mm conduit for uses that we have not yet thought about. We're confident those uses will be forthcoming!

4. FACILITY DESIGN AND CONSTRUCTION

4.1 1.0m telescope enclosure requirements

Required maximum tolerances for telescope enclosures:

- Wind speeds of 150kph in the closed condition. Must close safely in 60kph winds.
- Light-tight, to allow daytime calibrations.
- Telescope can move to all operating angles inside closed enclosure, and enclosure can completely close regardless of telescope position.
- Watertight against driving rain during winds mentioned above and during fog.
- Dust-tight against winds mentioned above down to sand-sized grains (0.0625 in).
- Thermal insulation to maintain daytime internal temps as close as possible to night-time operating temps.
- Telescope and all mirrors/parts should equilibrate to night-time operating temperature within 45 minutes of first opening enclosure (open e.g. 30 minutes before sunset).
- Enclosure opening/closing time to be less than 90 seconds.
- Enclosure opening mechanism to be maintained ice-free and protected from dust accumulation.
- Withstand direct lightning strike up to 120ka.
- Battery power (UPS) to close enclosure during sustained power-failure.
- All electrical services are wall surface-mounted for easy access, troubleshooting, and maintenance.

4.2 1.0m telescope enclosure design

As mentioned above, our building structural requirements are stringent and numerous. In addition, our "standard model" approach of pre-fabrication at our plant rather than on site requires that the observatory's circular wall be modular, with the ability to break down into 6 arcs that can be easily packed, shipped, and reassembled on site with a high degree of precision in a short period of time. To accomplish this, we developed a wall framing design built entirely from 16 gauge galvanized metal components, including 2x6 studs, top and bottom plates, and connector strapping.

Central to the design is specially fabricated curved metal 2x6 "track" that serves as the top and bottom plates of the wall, within which the metal 2x6 studs fit. This track is bent into the proper wall radius by crimping the inside edge every 75mm which creates "cells", and 171 of these cells combine to form a complete circle. These cell positions are then used to precisely define the locations of wall studs, fans, electrical penetrations and connections, external and internal siding attachment points, and the break points where the wall is divided into six arcs or modules.

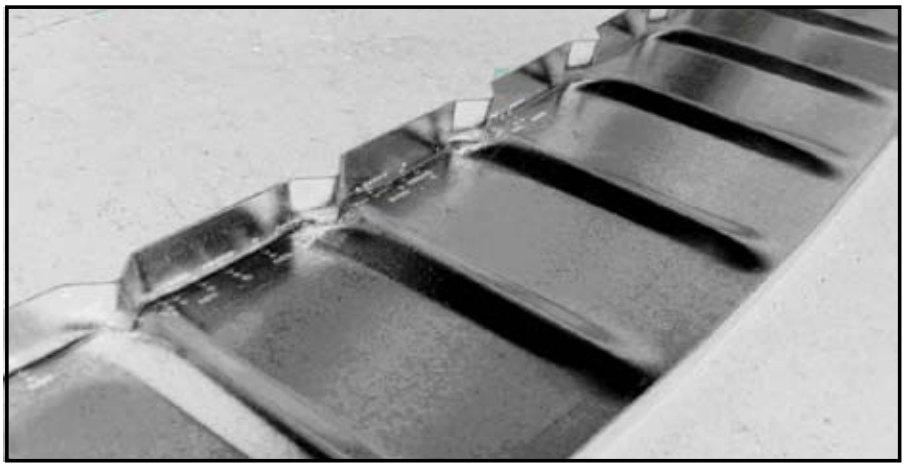


Figure 4. Photo of a section of the crimped bottom wall plate, showing "cells".

This ability to precisely define positions of every component of the wall system is key to enabling the manufacture of good replicas. With perhaps two dozen of these telescope enclosures eventually shipping to remote sites, having a consistent and known as-built condition is invaluable during deployment and maintenance operations.

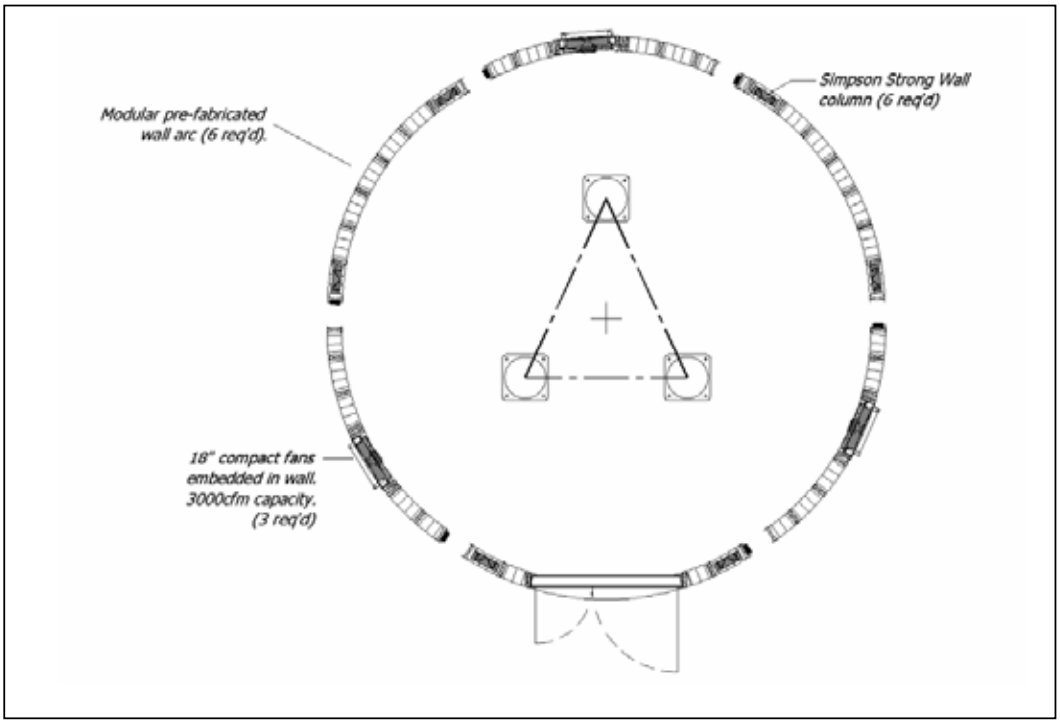


Figure 5. Exploded top view of 1.0m telescope enclosure's six wall modules, with major components labeled.

We use domes made by Ash Manufacturing Company, in Plainfield, Illinois, USA. Our domes are approximately six meters in diameter with an extra wide 2.1m shutter aperture (the wide aperture allows craning the telescope mounting into the enclosure in one piece). With our current 1.0m telescope configuration inside, we have a viewing angle range of seven degrees above the horizon to three degrees past the zenith. It would seem that a 1.0m aperture telescope with an f/2.5 primary is just about the largest instrument that can be housed within a dome of this size. Our swing clearance inside the dome is only a few inches.

The Ash dome was ordered equipped with four contactor bars on the dome ring for power transfer, and with the hydraulic lower shutter option. In addition, several modifications to the dome are deemed necessary to fully meet our needs. These modifications are implemented by us and not by Ash:

- We increased the clear swing radius by modifying some components of the dome interior.
- Added a robust labyrinth around the azimuth ring to create better light & dust tightness.
- Added extra/improved limit switches and proximity sensors to both shutter doors.
- Improved neoprene seals around shutter doors.
- Designed an azimuth drive mesh adjustment mechanism to eliminate spur gear thumping.
- Upgraded azimuth drive motors and gearboxes to allow triple speed and better performance.
- Improved and added tie-down points between dome and walls for better structural integrity.

The domes are grounded to our site grounding system with two stranded copper wires attached to dome wheel mounts separated by 180 degrees in azimuth. All our domes and other buildings on site are painted with titanium dioxide white

paint. This paint contains a high (38%) solids content that has good broad-spectrum reflectivity (92%) that lowers building internal temperatures by several degrees Celsius vs. the unpainted condition. Figure 7 below illustrates pointing range as well as the scaled size of the telescope relative to the dome internal clearances.

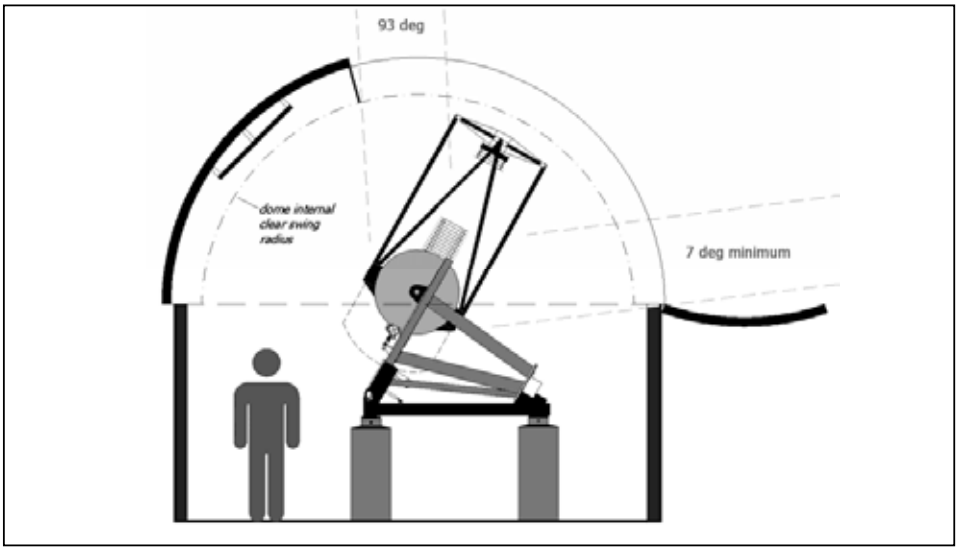


Figure 6. A typical 1.0m telescope enclosure cross-section. Person shown for scale.

4.3 0.4m telescope enclosure design

The 0.4m enclosure is a "clamshell" design similar to but much smaller than that used for the "Monet" telescope located at McDonald Observatory, Texas. However our enclosure employs many innovations that greatly improve operating reliability and weather tightness. For the most part, this design is a cost-driven solution to accommodate two telescopes within one enclosure, although reliability is also a factor. The footprint of the enclosure is about 2.5m by 4.5m.

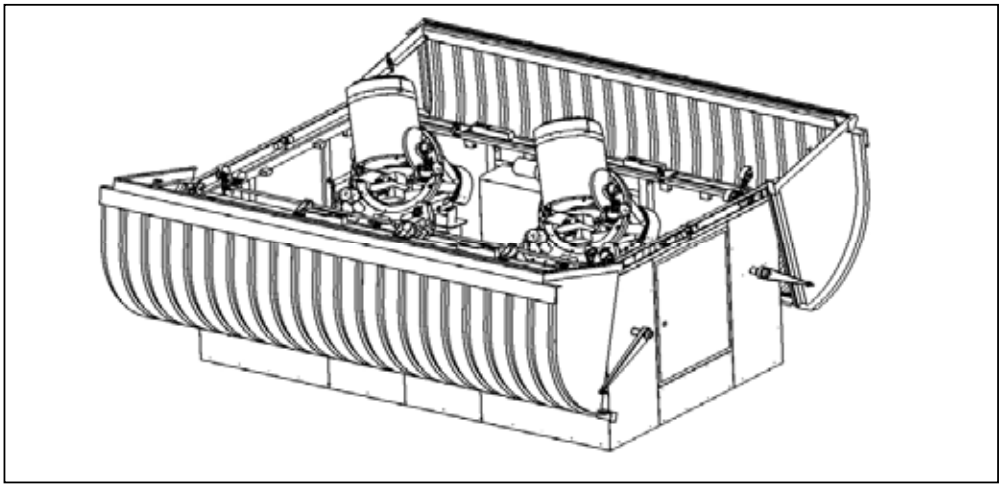


Figure 7. An isometric view of the dual 0.4m telescope enclosure called "Aqawan", designed by Annie Hjelstrom.

4.4 Support facilities

Each site has three support facilities: the SSB mentioned earlier but to be discussed in more detail here; a weather station with full compliment of instrumentation, and a storage building.

The Site Services Building is a specially modified steel shipping container, ISO certified for international travel. The SSB is the central nervous system of the site, distributing all services to facilities as required. It houses:

- IT rack with computers for telescope control and data reduction.
- Uninterrupted power source
- Key access control box
- Spectrograph

The building is equipped with air conditioning sufficient for the removal of approximately 3000 watts of heat generated by various electronic components inside. The A/C unit will run during the day, but at night ventilation fans take over and use the cool night time air to dissipate this heat, which eliminated the concentrated heat plume of the centralized A/C unit. The fans are capable of flushing the entire volume of the SSB about once every 30 seconds.

Figure 8. A typical Site Services Building before outfitting with electronics, computers, and other components.

A weather station is also an integral part of all sites. We use a fiber fed Campbell Scientific station with tower mounted instruments as follows:

- Temperature/relative humidity probe
- High accuracy temperature/relative humidity sensor
- High accuracy temperature/relative humidity monitor
- Leaf wetness sensor
- Wetness sensing grid

- Rain gauge
- Barometer
- Pyranometer (solar radiation monitor)
- Electric field meter (lighting detector)
- Particulate monitor
- Boltwood cloud sensor
- Ultrasonic wind sensor

Because of the autonomous nature of our observatory sites, weather data generated by this system has the ability to cause the telescope enclosures to automatically close to ensure the safety of telescopes and equipment.

5. SHIPPING, DEPLOYMENT, AND MAINTENANCE OPERATIONS

5.1 Shipping considerations

Our modular component designs allow packing into shipping containers efficiently. Enclosure walls separate into six arcs that nest nicely into the container space (See Figure 9 below).

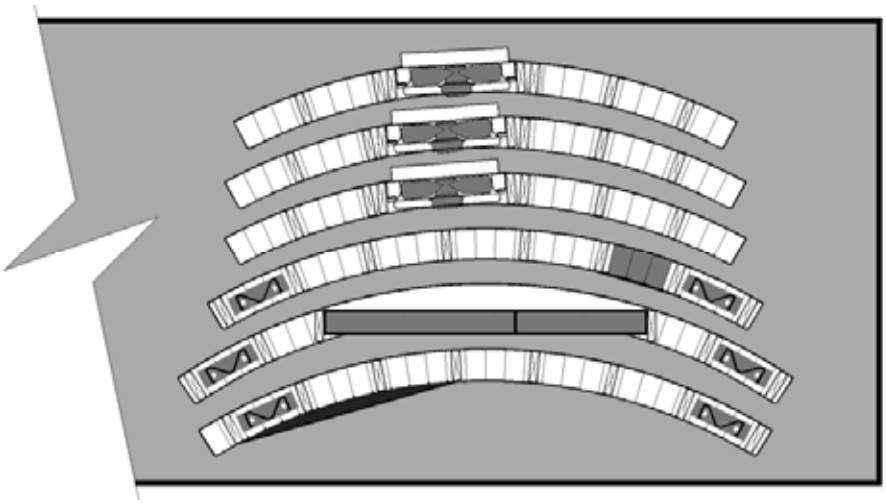


Figure 9. Enclosure walls separate into six arcs or modules that nest nicely into a standard shipping container.

Wall modules, spare parts, etc. are palletized inside the shipping container for ease of loading and unloading. The 1.0m telescopes will ship in two major assemblies: the OTA and the mounting. Optics are removed and packaged separately for their safety. Both M1 and M2 have specially designed containers to protect them during shipping. All components necessary for reassembling one 1.0m telescope are packaged and shipped inside one standard 8'x20' shipping container.

5.2 Deployment of facilities

Once at site, all facility and telescope components can be rapidly deployed. Enclosure wall modules can be unpacked and assembled in only a few hours with no on-site construction other than drilling holes for anchor bolts, and with simple hand tools. Each wall module is designed to be handled and positioned into place by no more than 2-3 workers, and three sets of wall modules can be assembled on site in just one day. Domes are delivered to site directly from Ash Manufacturing and assembled weeks ahead of time by local observatory support personnel, so once our wall assembly is complete the domes are ready to be craned onto the wall units. This pre-planning and pre-assembly of components and modules should allow us to completely deploy three 1.0m telescope observatory facilities in just one week once our personnel arrive on site. Aqawans are likewise assembled from six smaller sub-assemblies in less than one day.

The SSB arrives on site at the same time as the enclosure wall modules, and is installed on its four concrete pads in a matter of hours. It arrives fully populated with all control systems, IT racks, computers, etc. The only work needing to be done inside the SSB is to install batteries into the UPS, and computers into the IT rack. At this point all wire pulls can be performed and connections and terminations made between the SSB and the telescope enclosures. Telescope shipment is timed for arrival after the site facilities are fully tested and operational. In this way the telescope deployment crew can concentrate solely on that task for best efficiency.

Because of pre-planning and pre-assembly of components and modules, it is expected that deployment of an entire site (facilities and telescopes) can be achieved in less than one month with a relatively small number of people.

5.3 Maintenance operations

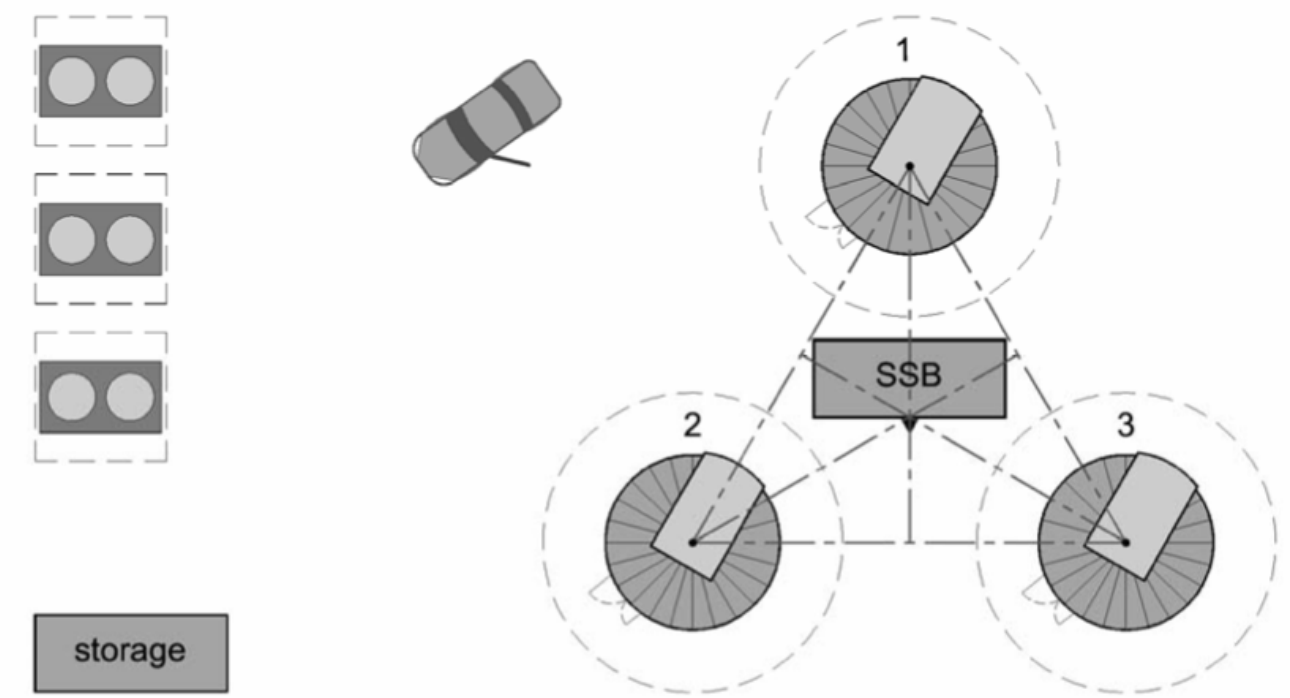
All our facilities, telescopes, and instrumentation are engineered to have long MTBF. But we do realize that occasional component failures will occur and need to be rapidly addressed. In the case of facilities, these failure points are likely to be fans, batteries, computers, and control panel electronic components. Our telescope and facility control panels use highly modularized electronic components. Spare units of more-likely-to-fail items are stored on site (along with proper documentation) for easy replacement by local site personnel. In the case of telescopes, we will stock on site spare RA and DEC drive motors and controllers, sensors, limit switches, and BlackFin control boards, and instructions for their replacement. Even spare optics will be stored (in California) and be ready for shipment to site in the unlikely event of a breakage during re-aluminizing operations. In this regard, we specifically specified to our 1.0m optical fabricator that M1 and M2 be “unmatched” to each other, so that only the damaged optical component need be replaced rather than an entire set.

Manufacturer product lines tend to change over time or in some cases discontinued. To mitigate the risk of critical replacement parts becoming unavailable, our California warehouse will stock a 20 year supply of spare parts so that interchangeability and compatibility of components can be maintained over the entire observatory life cycle.

In the case of the smaller 0.4m telescopes, if there is a serious failure we are prepared to send an entire telescope to site for replacement, and the failed unit would be returned in the same crate to our home facility for repair.

6. CONCLUSION

Although daunting, the deployment and operation of a globally distributed network of astronomical observatories can be made more manageable by careful engineering of interchangeable components, prefabrication and modularization, and a high degree of as-build uniformity across all sites.


1
SSB
2
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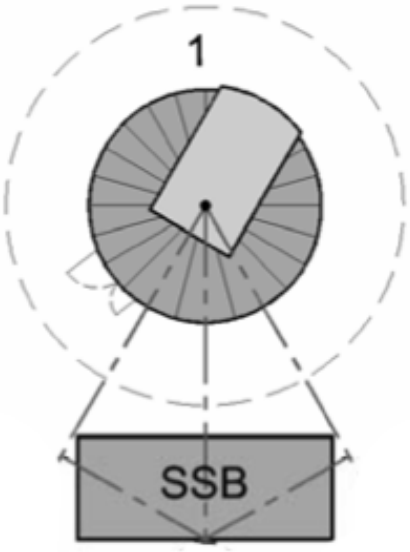
storage



20' x 8'

LOCAL AMENITIES AND UTILITIES

Information in this category is pending ongoing research and investigation. Items we are taking into consideration include:

- wastewater disposal and general water availability
- power
- potable water
- heat
- Generators can be used for electric generation
- fuel storage whether that will be Natural Gas, Propane, Diesel, Gasoline and that the fuel will need to be replenished
- Rainwater collection
- Renewable energy sources – Solar, Wind – These can be used along with a battery / capacitor bank to store energy as well
- Communication / Telephone / Wi-Fi Access
- What is the cost of heating oil in the area? (delivery options?)
- What is the cost of diesel fuel? (delivery options?) Gasoline delivered to site? Fuel storage requirements?
- Is there a wood pellet supplier in the region? (delivery options?)
- What is the cost of propane? (delivery options?)

REMOTE CONSTRUCTION METHODS

Road to the Field Station

- Code Compliance for width, and turnarounds. As an example depending on local codes and regulations, a turn around might be required every 200 yd's or so. See Tab 2: SITE EVALUATION.
- Grading limitations. If existing grades are too steep significant grading might be required. If this is the case determination of export material should be considered in the cost model.
- Requirements for paving or not – Obviously a paved road will be significantly more expensive. A consideration should be given to the expected lifetime of the road. The road can be initially constructed using compacted gravel / rock and paved later – a few years later.
- Drainage considerations. Road should be construction to allow for drainage to shed away from the surface to mitigate any long term damage as well as pot holes.
- Design considerations for the access road will be based on the construction equipment required for the field station as well as ancillary vehicles etc that will be needed to haul supplies / research equipment to the operating field station

Construction logistics

- The key will be modular or panelized buildings and structures. We will want to "assemble" the structures on site not construct. There are many choices and this can be built into the design of the structures & facility. We will want to minimize the quantity of construction equipment, materials and labor as much as possible.
- Airlift of equip / material of construction is a possibility
- Time will need to be spend "scripting" the construction sequence to ensure that all materials and tools are available at the site during the construction phase.
- Adequate availability of food and water as well as sanitation and wash facilities will need to be

made available for the construction crew.

Other Considerations for Design

- Utilities, power, potable water, heat. Generators can be used for electric generation, however you will need fuel storage whether that will be Natural Gas, Propane, Diesel, Gasoline etc – You will also need to consider that the fuel will need to be replenished. It is possible to determine if a well can be drilled & filtered for potable water for washing & drinking
- Renewable energy – Solar, Wind – These can be used along with a battery / capacitor bank to store energy as well
- Fire Fighting – Water Storage (Rain Water can be collected for this), ability to access site (CAL Fire) and/or safety measure to ensure evacuations in the event of a wild fire
- Sanitary Waste – Leeching field will need to be located
- Cooking area / Kitchen – Food Storage, cooling to mitigate spoilage; Preparation – wood, propane etc…
- Communication / Telephone / Wi-Fi Access

DESCRIPTION OF GALBREATH PRESERVE FACILITIES FOOTPRINT

Main Road (front gate to observatory turnoff) – These sections of the main road will need to be made accessible for emergency access vehicles. Additionally, the section of road from the main gate to the field station site will be made accessible for 2-wheel drive passenger vehicles. Road work will include some recontouring, gravel surfacing, and development of turnouts or turnarounds.

- 12 m corridor centered on road centerline
- additionally, any flat areas at least 10 m long immediately adjacent to road (for development into turnouts and turnarounds)

Bridges – The three bridges along the main road between and front gate and field station site will be replaced. Railcar bridges are currently proposed to reduce impacts to riparian and aquatic species. Railcar bridges can require pouring cement footings on either bank to support the railcar bridge.

- 30 m buffer surrounding bridges

Ponds – Development of a water source is proposed for the field station site. This will involve either drilling a well or using surface water. We want to avoid drawdown of surface water at the 3 ponds and impacts to riparian and aquatic organisms. We are planning on avoiding construction impacts to the ponds by limiting construction to areas on the east side of the main road. We have considered whether we could use the surface water at the roadside pond (northernmost). This pond is manmade.

Field Station Site – The field station is envisioned as cluster of buildings that provide capacity for 50-60 researchers, classes, and meeting attendees to stay overnight.

- the field station site was identified as all areas < 7% slope

Observatory Road (from main road to observatory site) – The existing road, an old logging road, will need to be improved. To allow for emergency vehicle access, the road would need to be paved because portions of it are between 16 and 25% grade.

- 30 m corridor centered on road centerline. Road exists as an old logging road. Note that road appears to peter out when it reaches grassland in a small saddle. Follow the saddle, veering slightly to your left to pick up the road as it goes to the top of the knoll.
- expanded area adjacent to main road. This is a possible backup site for the observatory.

Observatory Site

- facility footprint is 20 m x 25 m, currently envisioned as a cluster of 3 buildings with a road encircling the facilities that doubles as access and fire break.
- 30 m buffer surrounding the facility footprint. The only proposed disturbance in this area is tree cutting. Trees will be cut if they obscure the horizon.

Tab 5 :: Summary

REVISED PROJECT UNDERSTANDING & OBJECTIVES MOVING FORWARD

The design team has received information showing all of the facilities that "may" be built on a field station site, but have yet to determine what "should" be built, in what configuration, and in what manner. We will work in session with the stakeholder group, through investigative work on-site (discovery) and intensive work sessions off-site (brainstorming, confirmation and synthesis) to form priorities and goals to guide the completion of the conceptual design.

Our desired outcomes from charette discussions:

1. Evaluate the site constraints of the development area, and discuss opportunities for facility development, including discussions on aesthetics, quality, orientation, and scale; Evaluate the program requirements of desired parking, infrastructure and facilities, and determine a reasonable development footprint that is appropriate for this location.

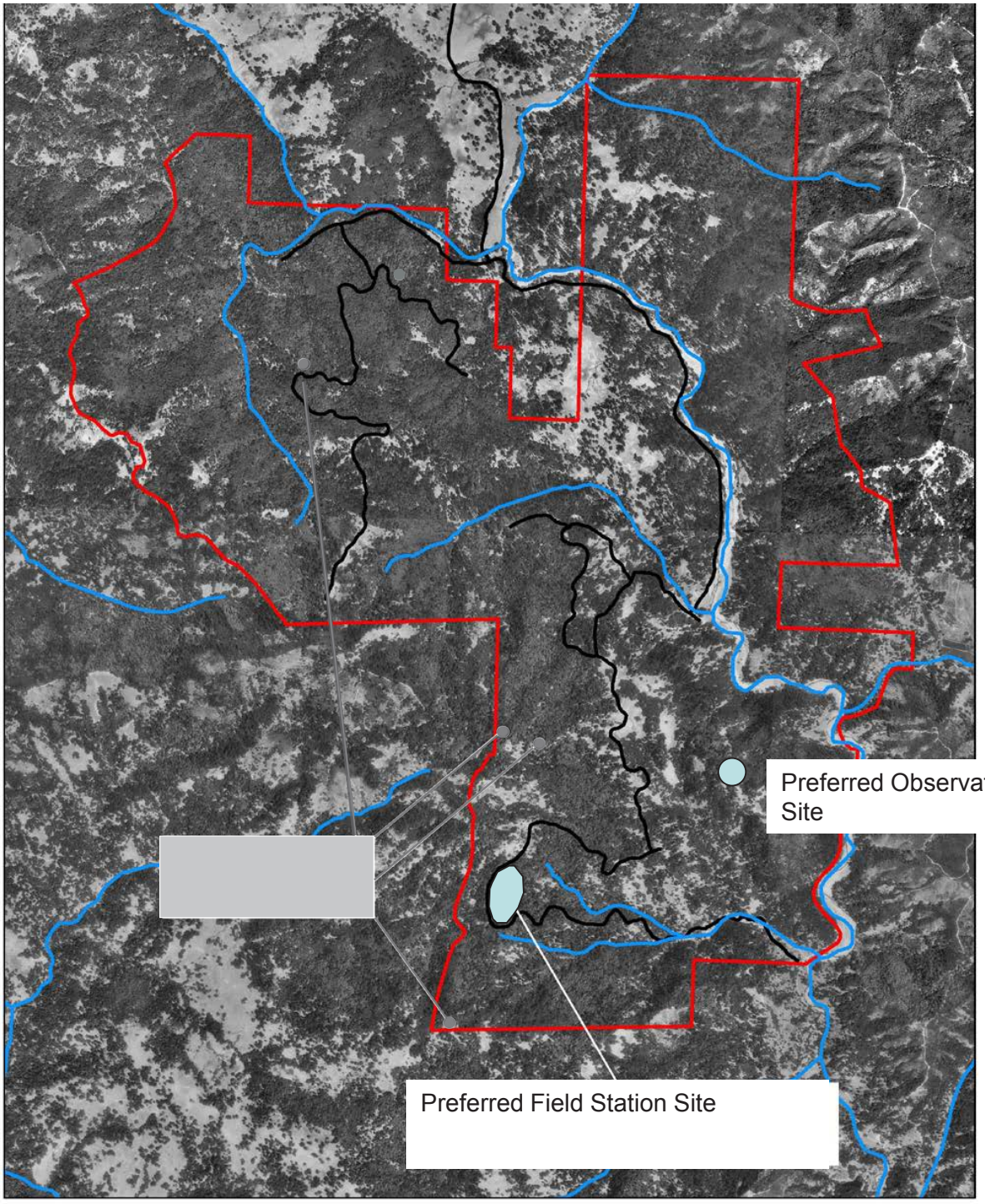
2. Evaluate the budget constraints of the known elements of construction: road improvements to development area, basic infrastructure (water, septic, fuel, electricity, equipment parking) and determine how much money is available for facility construction- and what that needs to reach critical mass for phase I fundraising.

3. Prioritize the list of desired facilities to create a phasing plan for which components should be developed first, as a catalyst for ultimate project success.

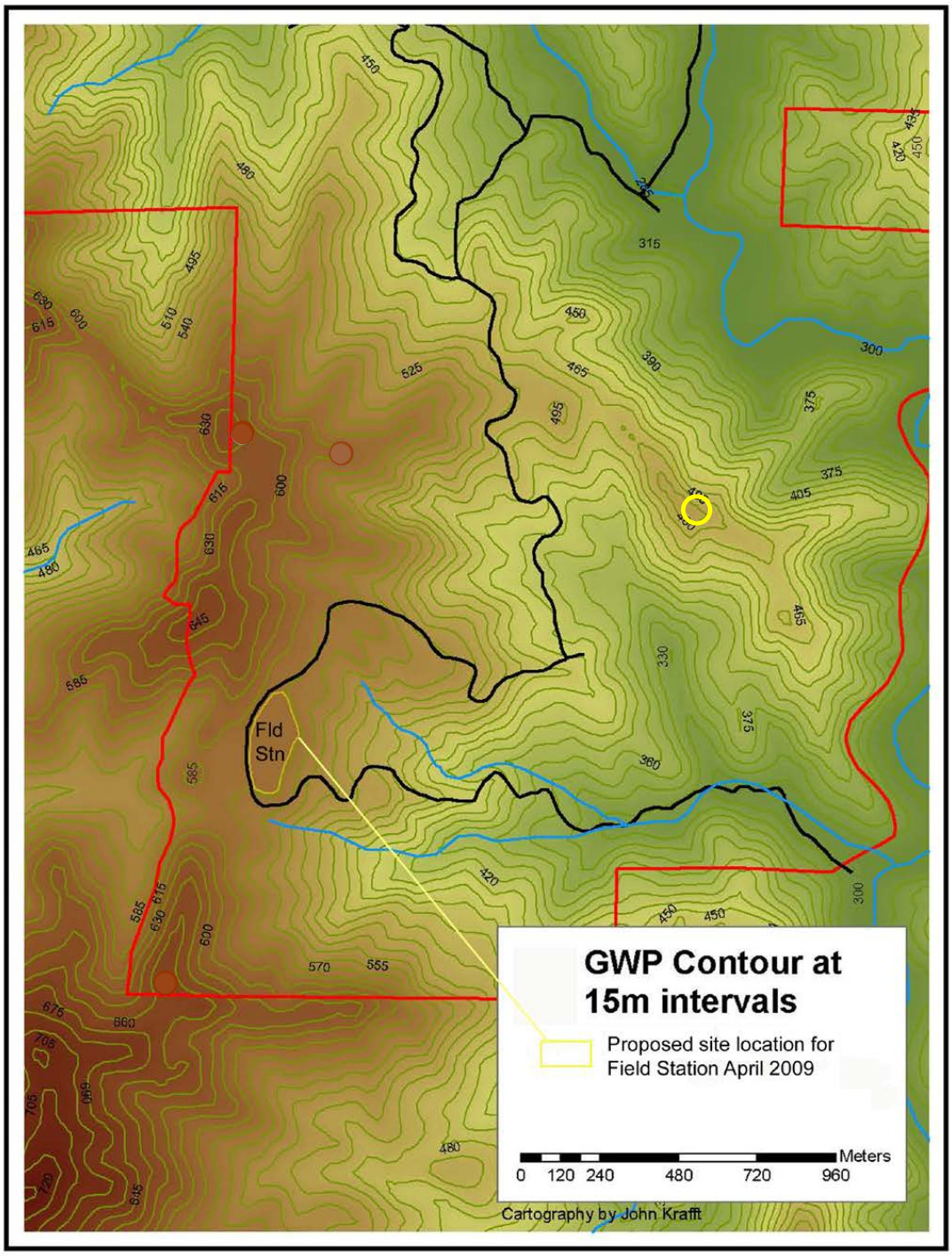
At the conclusion of the charrette, our team will combine the investigation information, with the field findings and the robust background information gathered by stakeholders, including mission and goals, to develop a successful conceptual design for the site, suitable for detailed review by SSU.

Tab 6 :: Exhibits

Project Location Map

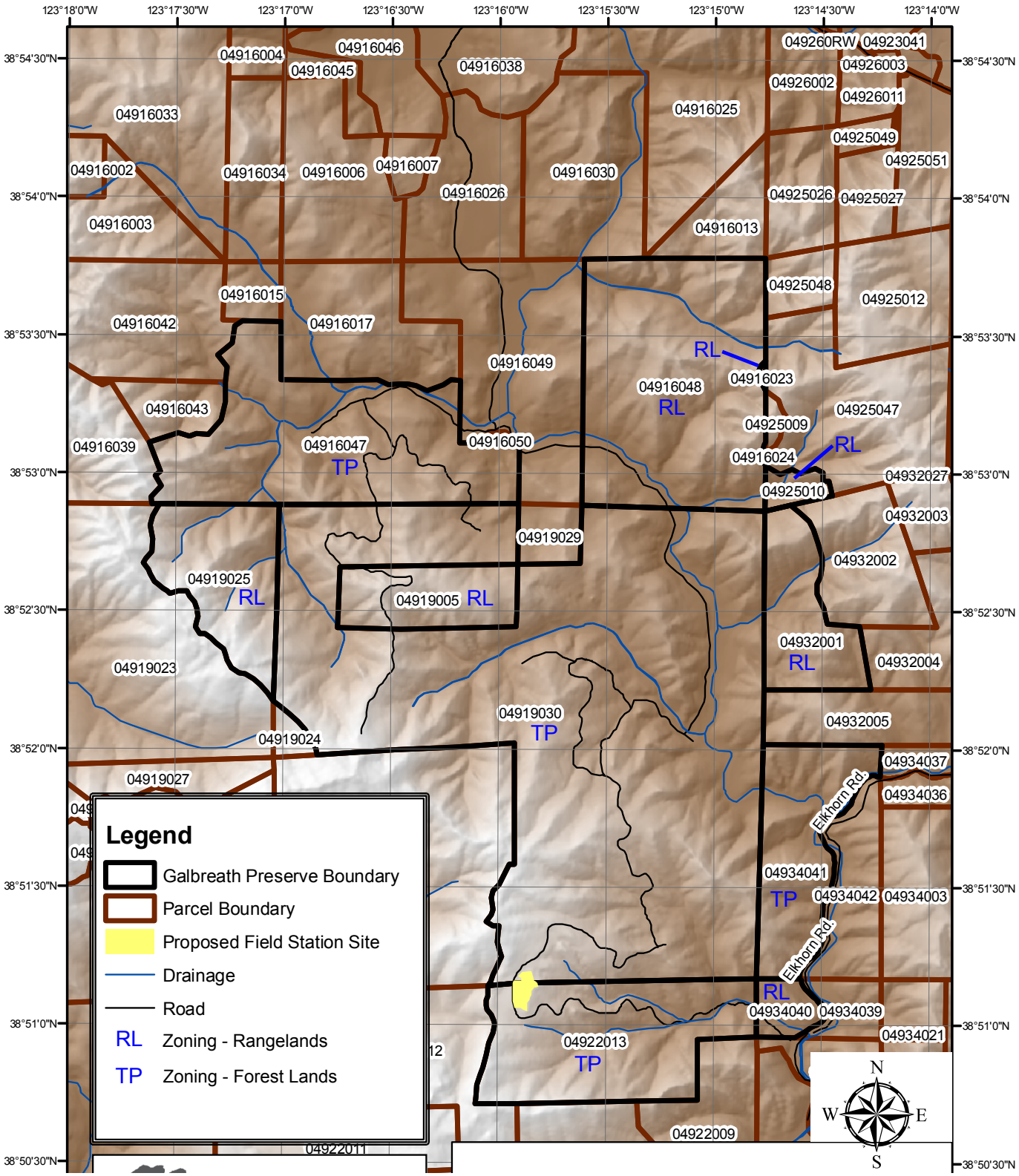


Updated Aerial Map
4/22/2011



Updated Topography Map
4/22/2011


Galbreath Wildlands Preserve
Proposed buildout for
Field House April 2009
NTS
Parking
Field
Station
Garage
Bathhouse
Cabins
Footpaths
New Roadways
Caretaker
Residence
Existing Road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TP
04934042
04934003
Elkhorn Rd.
RL
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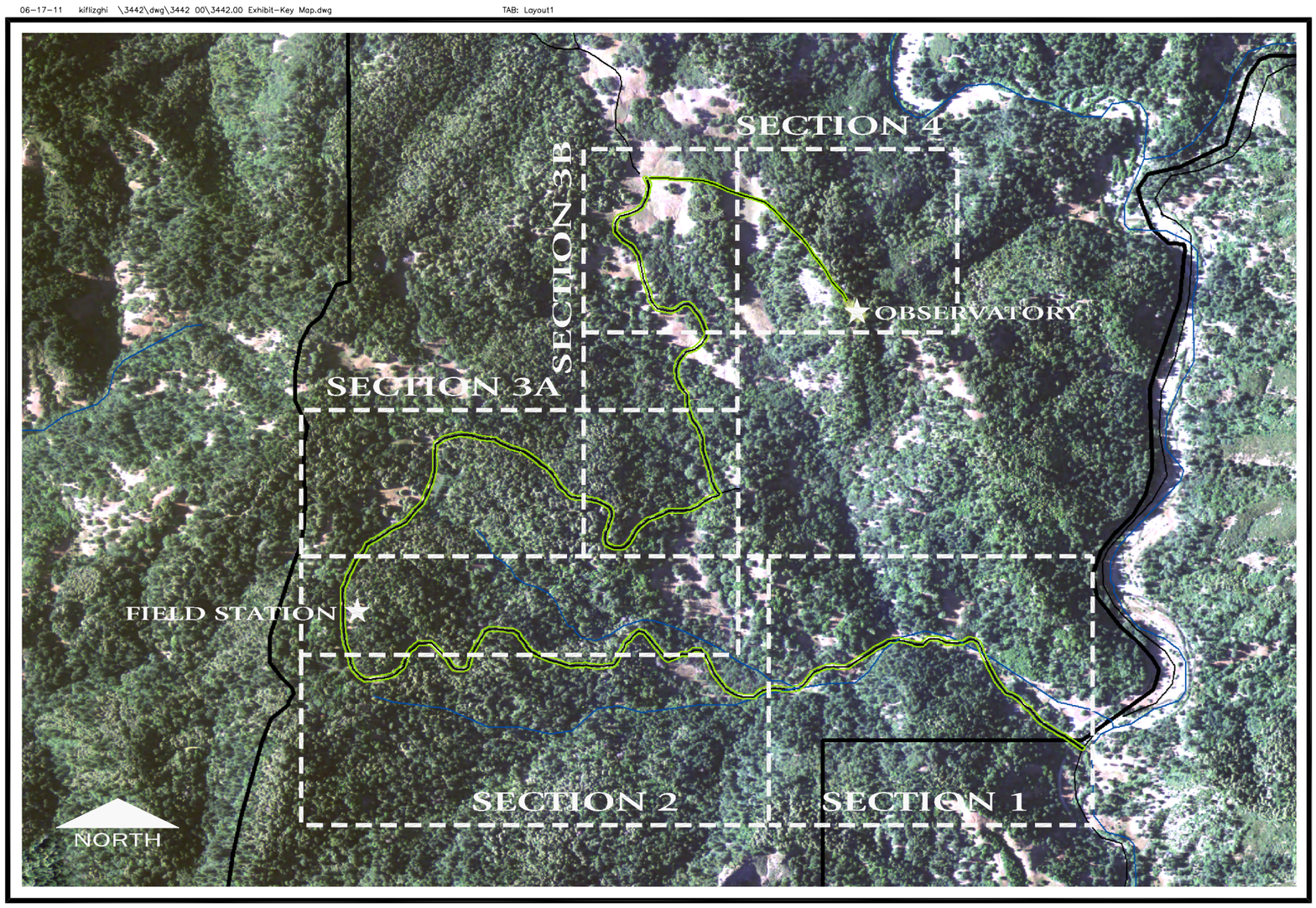
04934039
04934021
04922013
TP
04922009
04922011
Legend
Galbreath Preserve Boundary
Parcel Boundary
Proposed Field Station Site
Drainage
Road
RL Zoning - Rangelands
TP Zoning - Forest Lands
N
W
E
S



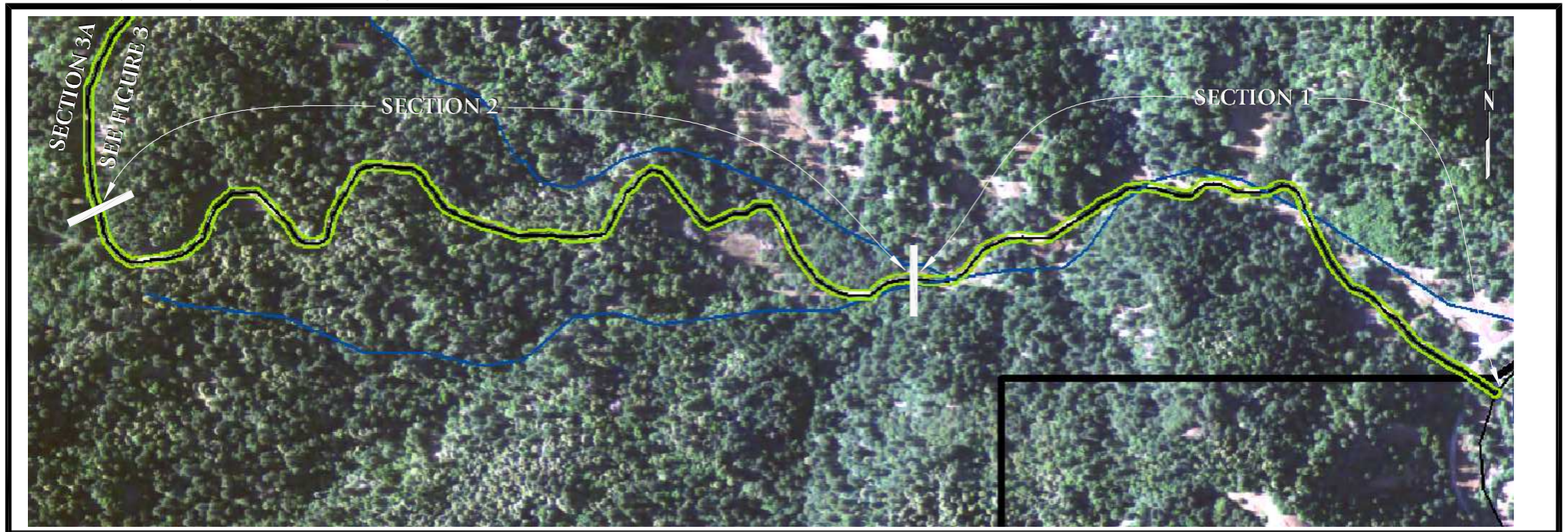
Brelje & Race
CONSULTING CIVIL ENGINEERS

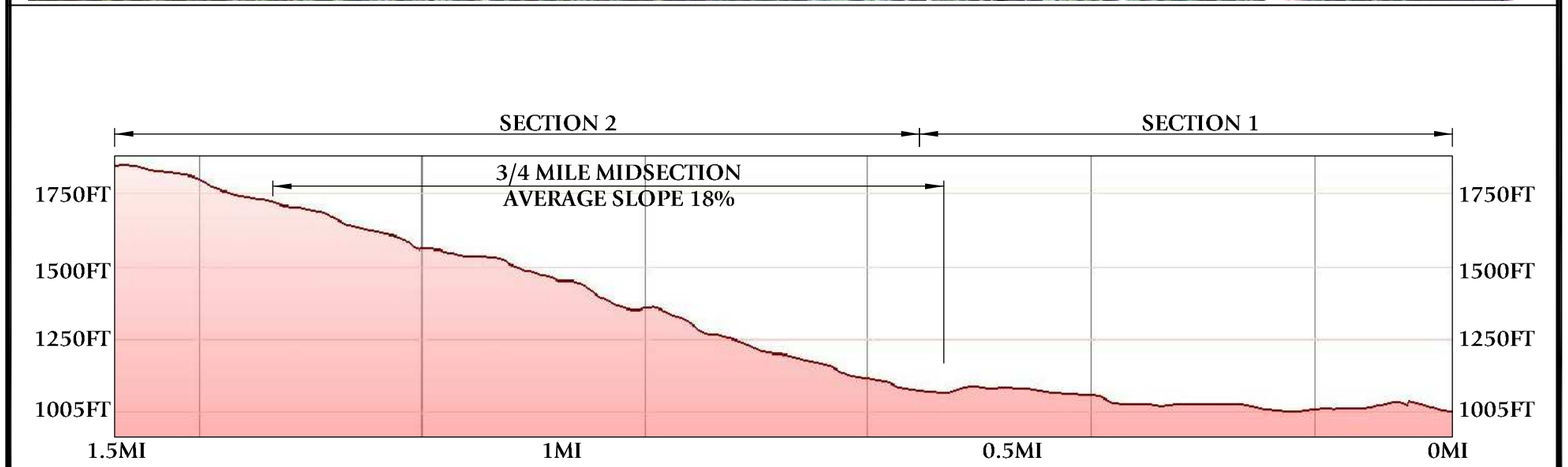
FIGURE 1

KEY MAP - ROAD STATIONS

GALBREATH WILDLAND PRESERVE

06-17-11 mobley \3442\dwg\3442 00\3442.00 Exhibit-GE P&P.dwg TAB: SECTIONS 1AND2





SECTION 1 - 0.0 MI TO 0.6± MI
SECTION 2 - 0.6± MI TO 1.5± MI

GALBREATH WILDLAND PRESERVE
ACCESS ROAD

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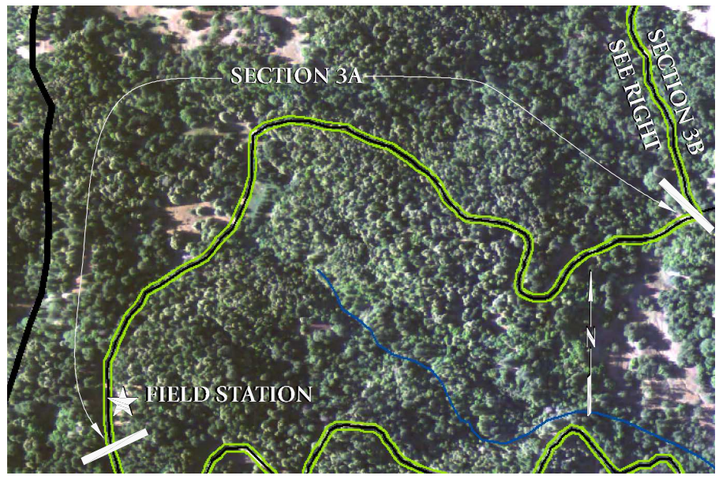
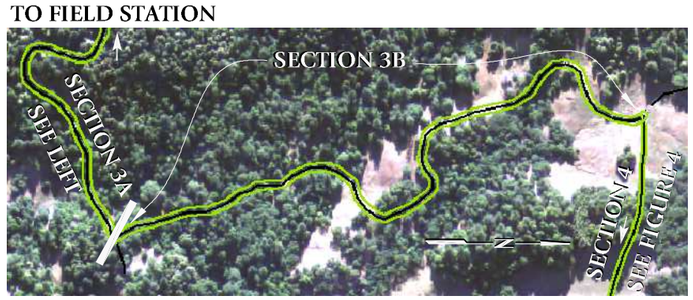
FIGURE 2

06-17-11 mobley \3442\dwg\3442 00\3442.00 Exhibit-GE P&P.dwg TAB: SECTION 3Aand3B





SECTION 3A - 1.5± MI TO 2.6± MI
SECTION 3B - 2.6± MI TO 3.3± MI

GALBREATH WILDLAND PRESERVE
ACCESS ROAD

FIGURE 3

Brelje & Race
ENGINEERING CONSULTANTS

06-17-11 mobley \3442\dwg\3442 00\3442.00 Exhibit-GE P&P.dwg TAB: SECTION 4

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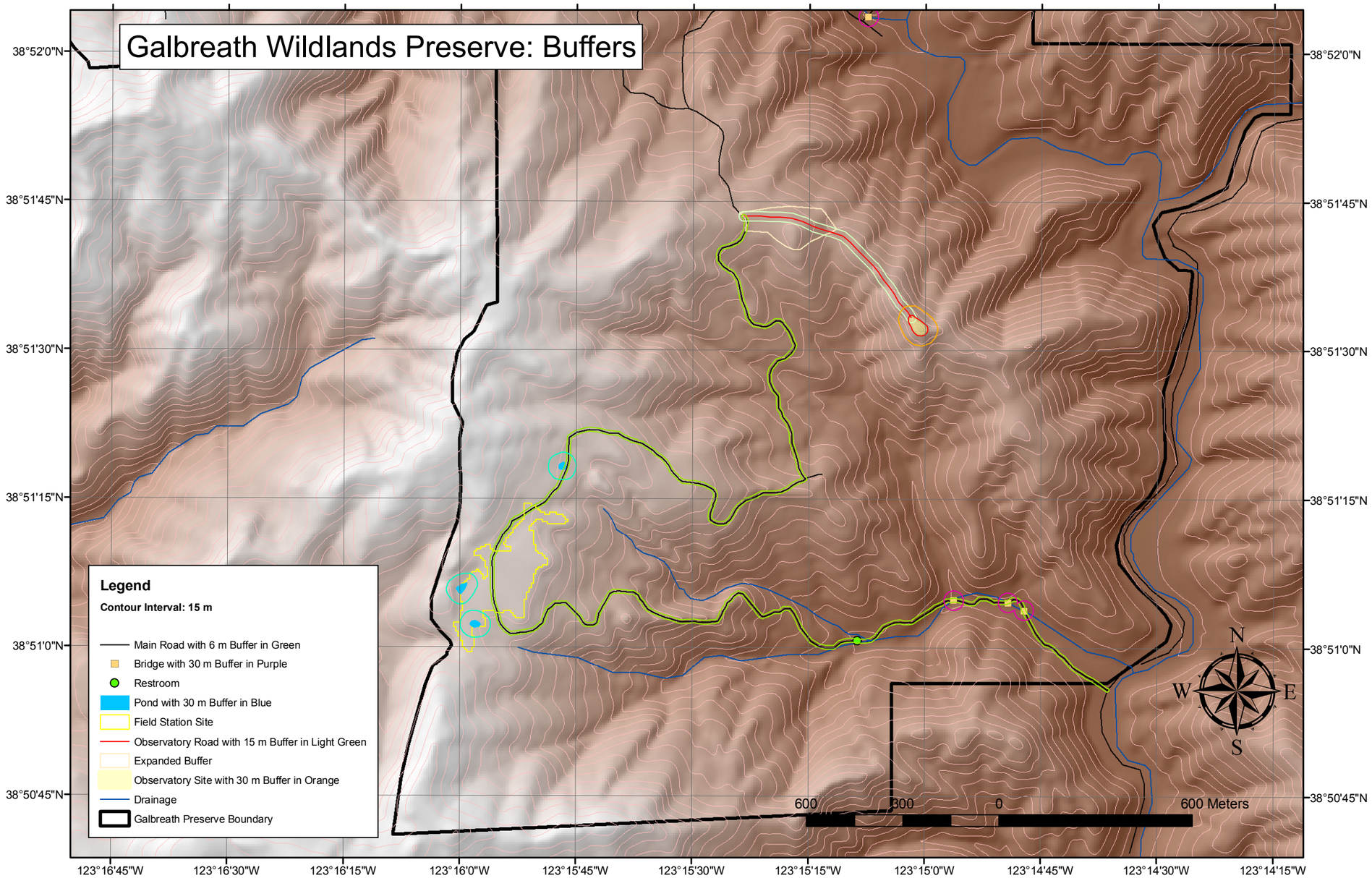
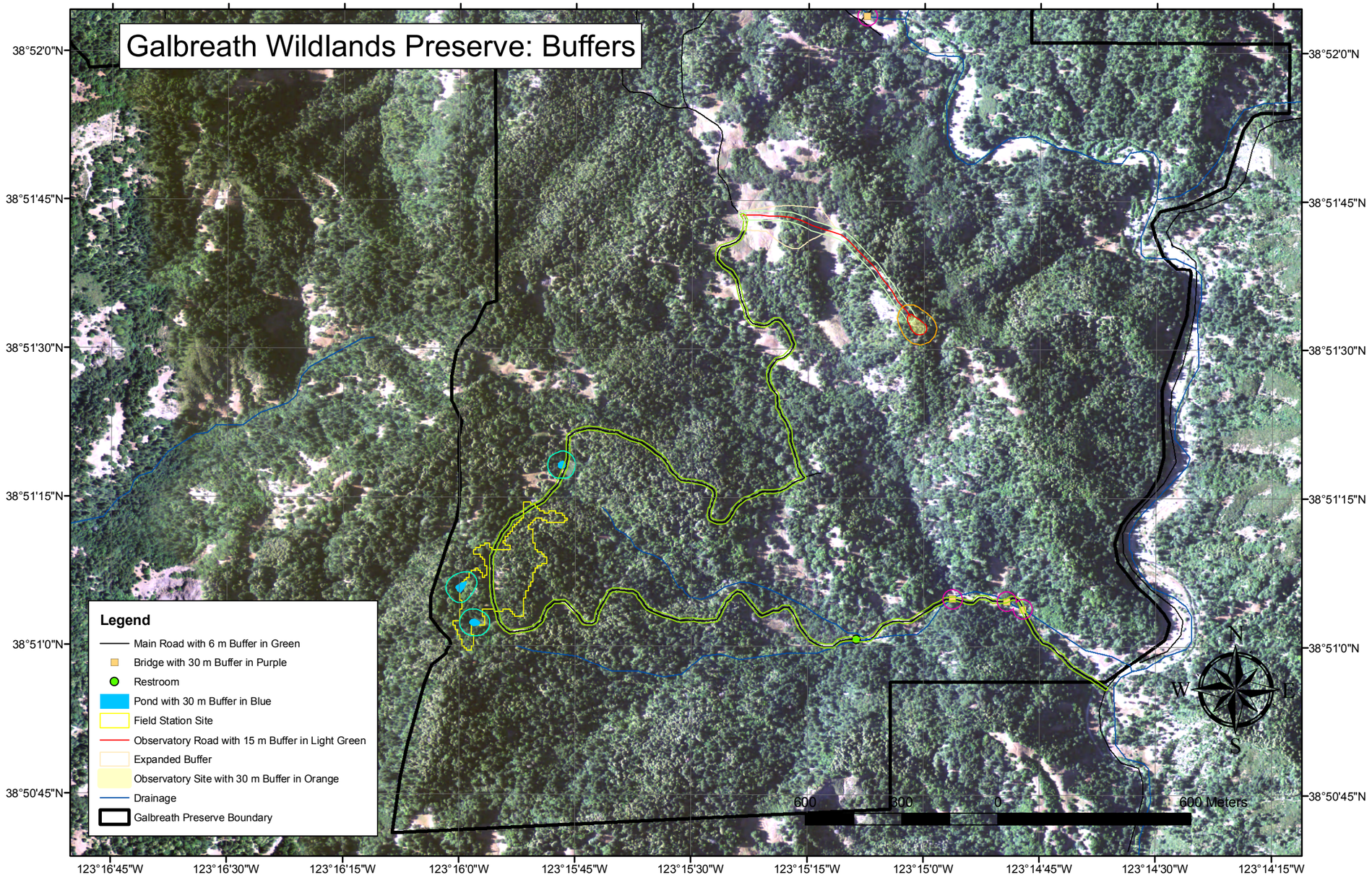
427 Aviation Blvd., Suite 220 Santa Rosa, CA 95403 T 707 576 1222

FIGURE 4

SECTION 4 - 3.3± MI TO 3.8± MI

GALBREATH WILDLAND PRESERVE
ACCESS ROAD


Galbreath Wildlands Preserve: Buffers
38°52'0"N
38°51'45"N
38°51'30"N
38°51'15"N
38°51'0"N
38°50'45"N
123°16'45"W
123°16'30"W
123°16'15"W
123°16'0"W
123°15'45"W
123°15'30"W
123°15'15"W
123°15'0"W
123°14'45"W
123°14'30"W
123°14'15"W
Legend
Contour Interval: 15 m
Main Road with 6 m Buffer in Green
Bridge with 30 m Buffer in Purple
Restroom
Pond with 30 m Buffer in Blue
Field Station Site
Observatory Road with 15 m Buffer in Light Green
Expanded Buffer
Observatory Site with 30 m Buffer in Orange
Drainage
Galbreath Preserve Boundary
600
300
0
600 Meters
N
W
E
S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