

# **Appendix D Dewatering Plan**

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TECHNICAL  
MEMORANDUM

**Dewatering Plan**

San Luis Obispo County  
Los Osos Collection System

Final

March 2012



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## Appendix

Central Coast Region Letter dated May 27, 2011, Use and Disposal Plan for Construction Dewatering, Los Osos Project

## Acronyms

AFY	acre-feet per year
CDFG	California Department of Fish and Game
CDP	Coastal Development Permit
FM	forcemain
ft	feet
ft/d	feet per day
gpd	gallons per day
gpd/ft <sup>2</sup>	gallons per day per square foot
lf	linear feet
LOVR	Los Osos Valley Road
ml/l	milliliter per liter
MPN	most probable number
PS	pump station
REW	recycled water
RWQCB	California Regional Water Quality Control Board Central Coast Region
sq ft	square feet
USACE	United States Army Corps of Engineers
WWTP	wastewater treatment plant

# Los Osos Collection System

## Dewatering Plan

CDM Smith evaluated the construction dewatering requirements for the Los Osos collection system and estimates that the groundwater disposal requirement is approximately 620 – 1,300 gpm. CDM Smith considered twelve disposal alternatives including combinations of construction use, the new retention facility at the Mid-Town site, the new Broderson leachfield site, the existing public retention basins, the existing storm drains, and agricultural reuse.

Based on this analysis, CDM Smith recommends a four-stage approach. The first stage is to use construction use and treatment since no groundwater retention sites will be available when work starts. The second stage will involve construction use and use of the new Mid-Town retention site and the existing retention sites to the fullest extent possible. Naturally, the infrastructure to get water to Mid-Town groundwater retention basin will need to be installed before use. The third stage is to build the Broderson leachfield system and the recycled water pipeline to get flow there. The intent would be to use the Mid-Town retention site as the primary disposal site, using the Broderson site to offset the peak groundwater disposal. Construction use will be implemented throughout construction in combination with the other disposal alternatives. Disposal to the Mid-Town site augmented with the Broderson leachfield site appears to be a viable and cost-effective means to dispose of the entire range of the anticipated groundwater disposal (approximately 620 to 1,300 gpm for a single area or 2,500 to 4,900 gpm for up to 4 concurrent areas) throughout construction. Groundwater production in excess of 6,500 gpm would require a fourth approach involving agricultural reuse along Clark Valley Road. This would be necessary if the groundwater production exceeds what could be disposed of with the combined capacity of the construction use + Mid-Town retention site + Broderson leachfield site. Disposal to storm drains will always be an optional disposal method, but will likely require treatment for a range of constituents, primarily fecal coliform, ammonia, pH, and sediment.

### 1. Summary of Proposed Approach

The Contract Documents will specify the following conditions for the disposal of construction dewatering water:

1. The Contractor will be encouraged to utilize the collection system sewer mains, conveyance force main, and the recycled water force main for the conveyance of construction dewatering water to the new Mid-Town groundwater retention site. This will require coordination between the construction contracts for the different bid packages.
2. The Contractor will be encouraged to utilize the collection system sewer mains and force mains or recycled water lines for the conveyance of construction dewatering water to selected manholes or pump station wet wells and to the force mains and the recycled water force mains as needed.

3. The phasing (schedule) of construction/dewatering and construction of disposal sites must be managed to ensure proper disposal of dewatering effluent.
4. The selected manholes or pump station wet wells or recycled water force main may be used by the Contractor to install temporary drainage pumps to convey the construction dewatering water to disposal locations with temporary piping. (The wastewater pumps to be provided for the Project will not be allowed for use as drainage pumps.)
5. The construction dewatering water will be pretreated by desilting with an inline sediment settling tank when required before discharge to sewer mains, pump station wet wells, and recycled water pipeline.
6. At completion, the Contractors will be required to clean the newly constructed sewer mains, manholes, wet wells, and force mains if used for conveyance of construction dewatering.

## 2. Introduction

This dewatering plan was developed by CDM Smith for the proposed Los Osos Collection System. The collection system will be a conventional gravity collection system serving 15,000 residents with pump stations that collect wastewater from individual parcels within the service area and convey these flows to the Mid-Town site. The system will include approximately 195,000 linear feet of gravity sewer mains ranging in size from 8-inch to 18-inch in diameter, 790 manholes, 4,700 sewer laterals, six duplex and two triplex pump stations, twelve pocket pump stations, the Mid-Town Pump Station, and 28,000 linear feet of force main ranging in size from 2-inches to 12-inches in diameter.

As described in the March 2004 Geotechnical Report for the Los Osos Wastewater Project by Fugro West, groundwater conditions are notoriously shallow in many areas of the communities of Los Osos, Baywood, and Cuesta-by-the-Sea. On the basis of the groundwater conditions encountered at the site, dewatering will be a critical aspect of construction for the pipeline trenches in areas with shallow groundwater.

CDM Smith prepared this construction dewatering plan for the extraction, treatment, storage, and disposal of groundwater. The plan includes anticipated quantities, treatment methods, and storage and disposal locations and practices. The material provided is sufficient to partially satisfy pre-construction Coastal Development Permit (CDP) conditions 10 and 14.

The County is preparing an application for an NPDES Construction Activity Storm Water Permit. The application will define appropriate BMPs to be employed during project construction and the use of construction dewatering and the requirements for disposal of water from dewatering activities.

The Contractor will be required to submit a thorough dewatering plan prepared by a California licensed professional engineer. The Contractor's dewatering plan shall include descriptions of the dewatering water disposal approach with locations and methods of dewatering water collection, conveyance, and discharge for disposal.

The dewatering plan presented in this document is not intended to replace the Contractor's dewatering plan but is intended to think through the anticipated dewatering plan requirements to evaluate their impact on design and construction of the Los Osos Collection System.

### 3. Hydrogeologic Setting

#### 3.1 Groundwater Levels and Subsurface Geology

Shallow groundwater is common over about 18 percent of the entire project area. In areas A and B, which are adjacent to Morro Bay, shallow groundwater is common to about 21 percent and 36 percent, respectively. The geotechnical report states that the depth to groundwater in the field explorations ranged from approximately 1 foot to greater than 80 feet below the ground surface over the site area. The geotechnical report also observed that there were numerous springs and areas of ponded water at the site.

Within the low lying areas of the site along the Morro Bay shore, and interdunal depressions such as along Paso Robles Avenue and Ramona Avenue, the geotechnical report stated that groundwater was encountered at shallow depths (less than 10 feet below ground surface), and that the dune sand was typically loose and readily caved into backhoe test pits and drill holes excavated within those areas.

Domestic water is supplied via deeper wells penetrating the deeper aquifer in the Paso Robles Formation. Groundwater dewatering will be in the shallower groundwater above the Paso Robles Formation. Hence, construction dewatering should not have a direct impact on the domestic water wells.

#### 3.2 Bacteria

The potential presence of fecal coliform bacteria in the construction dewatering water due to contamination from the proximity of septic tank effluent is possible, but difficult to predict. The District excavated one test pit in July 2004 at the intersection of El Moro Avenue and 6th Street to reach groundwater that would be representative of construction dewatering water. Water was reached at a depth of 10 to 11 feet below grade and a sample obtained. (Note that the proposed sewer main at this location will be approximately 10 feet below grade.) The sample was analyzed for bacteria with the following results:

E. Coli	<1 MPN / 100 ml
Total Coliform	5500 MPN / 100 ml

The May 27, 2011 letter from the California Regional Water Quality Control Board Central Coast Region (RWQCB) requires that the Contractors monitor the dewatering discharge to surface waters for fecal coliform and that dewatering water not exceed 14 MPN/100 ml of fecal coliform bacteria with no more of than 10 percent of the samples exceeding 43 MPN/100 ml prior to discharge to receiving waters. This may require disinfection and, if chlorine is used, the discharge must be dechlorinated prior to discharge to receiving waters. Disinfection may also be required for disposal to agricultural reuse for certain crops such as edible food crops as described in the Effluent Reuse and Disposal Alternatives Memo by Carollo Engineers (Carollo Engineers 2008b). However, disinfection would not be required for temporary land disposal to retention basins and the new Broderson leachfield site.

### 3.3 Sediment

The Contractor will be required to insure that the construction dewatering water is not discharged to surface waters with sediments in excess of 3 ml/l settleable solids. Where the approach used to extract the groundwater are wells or well points, auxiliary processes for desilting are not expected to be needed except during initial start up of the well. Where construction dewatering water is extracted from open excavation sumps that may pick-up sediments and silts, the Contractor will be required to provide a means of desilting the water prior to discharge. The desilting operation would probably include detention and settlement in baffled Baker tanks. Desilting may be required for temporary land disposal to retention basins. Desilting will be required for disposal to the Broderson leachfield to prevent long term clogging.

### 3.4 Additional Treatment That May Be Required

The RWQCB may require additional levels of treatment for nitrate, ammonia removal, and pH adjustment if pH is higher than 7 for disposal to surface waters. This additional treatment is not anticipated at this time based on recent groundwater sampling.

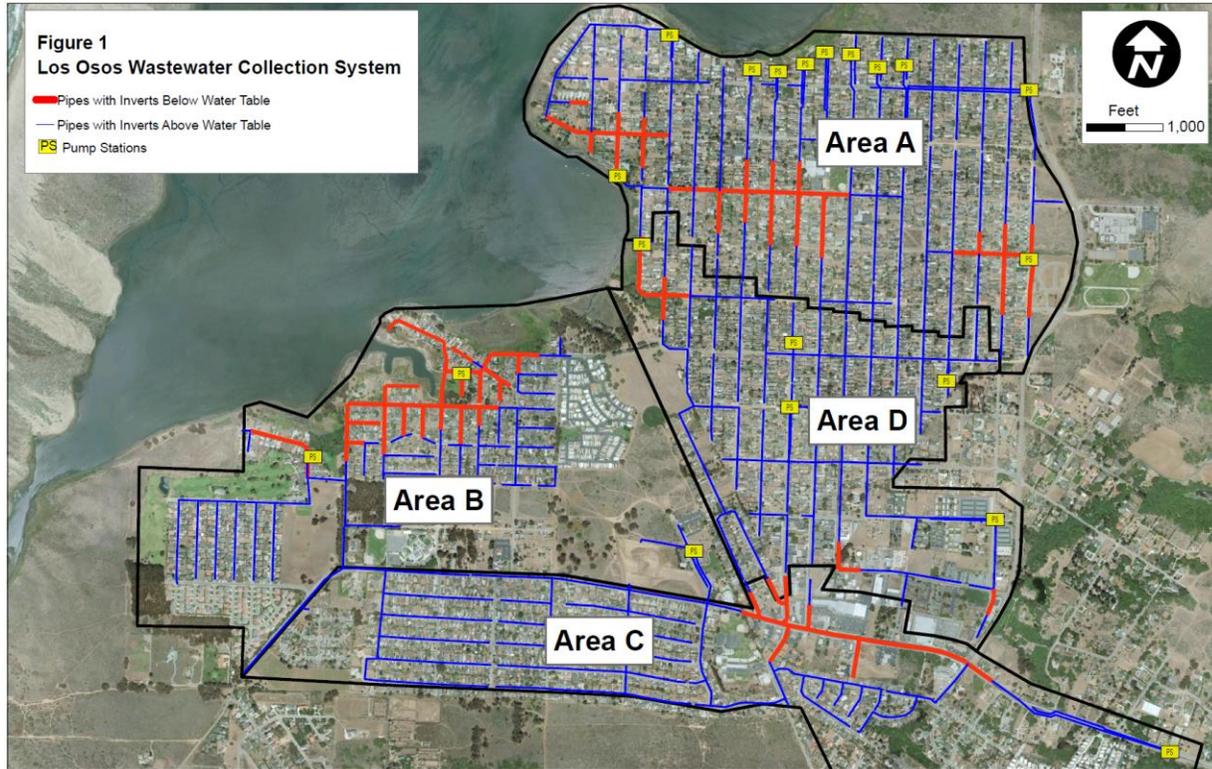
The Shallow Groundwater Water Quality Sampling and Analysis report dated February 2, 2012 prepared by Fugro Consultants, Inc. indicates that there are no detectable levels of asbestos, pesticides, semi-volatile compounds, or dioxin. Detectable levels of arsenic, chromium, copper, lead, mercury, nickel, and chromium III were observed. However, detections at or above the method detection limit are not necessarily above the screening level required by the RWQCB. This groundwater analysis and comparison will be required as part of the Contractors construction dewatering program.

## 4. Anticipated Dewatering Areas

The general alignment of the sewer mains and the locations of the pump stations for the collection system are shown in Figure 1. The depth of the sewer mains ranges from 5 feet to over 20 feet below grade. Areas where the sewer will be located below the groundwater are also shown in Figure 1 as red lines. The approach used to estimate areas where the depth of the as-designed sewer was below the estimated groundwater depth involved a digitized surface of the water table from groundwater contour data for the 1999 — 2003 time period as described in Plate 8 of the 2004 Fugro Geotechnical Report. The depth of the groundwater was then compared to the proposed pipe invert elevation at each manhole. The result was that approximately 35,700 feet of gravity sewer pipe will be installed at or below the water table with an additional 7,600 feet of conveyance force main and recycled water main. Based on the water table elevation data used in this analysis, of the pipes that will be installed below the water table, approximately  $\frac{3}{4}$  of pipe inverts are less than 5 feet below the water table. Recent groundwater sampling described in the Shallow Groundwater Water Quality Sampling and Analysis report dated February 2, 2012 prepared by Fugro Consultants, Inc. indicates that the water level monitored on December 7, 2011 are generally similar to those observed in the previous geotechnical investigation for the 2004 Fugro Geotechnical Report.

In areas of the collection system that are in high groundwater, more stringent construction inspection measures are warranted to ensure proper installation. The standard for construction oversight is for “observation” of the work, with close inspection provided on a random sample of

the work. Additional verification of quality is provided by testing requirements. CDM Smith will add a condition that in areas of high groundwater all joints and pipe sections must be visually inspected for proper installation and joint integrity. The areas where construction excavations may encounter groundwater are located within the highlighted areas depicted in Figure 1.



**Figure 1. Los Osos Wastewater Collection System**

The six areas of anticipated construction dewatering are located in the following general vicinities:

- Collection System Area B - The Solano Pump Station (PS) and Lupine Pump PS area (along Binscarth Road and western Ramona Avenue)
- Collection System Area A west - The West Paso and Baywood PS area (along western Santa Maria Avenue and western El Moro Avenue)
- Collection System Area A east - The East Paso PS area (along eastern Paso Robles Avenue)
- Collection System Areas C and D - The Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way.
- Recycled Water Pipeline Area C - The Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and to Fairchild Way just beyond Oak Ridge Drive.

- Conveyance Force Main Area C - The Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way to just beyond Oak Ridge Drive.

Area A. Collection system area A is a coastal area known as Baywood Park and is the northern-most area of the project bounded by Morro Bay and Santa Paula Avenue on the north and west, South Bay Boulevard on the east, and a jagged saw-tooth line that runs diagonally southeasterly from Paso Robles Avenue and 3<sup>rd</sup> Street to Ramona Avenue and South Bay Blvd.

Area B. Collection system area B is a coastal area known as Cuesta-by-the-Sea and is the central western area of the project bounded by Morro Bay on the north and west, Ferrell Avenue on the east, and Los Osos Valley Road (LOVR) in the south.

Area C. Collection system area C is the southern-most area of the project bounded by LOVR in the north, Highland Drive and Green Oaks Drive in the south, and Sunny Oaks in the east.

Area D. Collection system area D is the central area of the project bounded by Area C on the south, Ferrell Avenue (Area B) on the west, and South Bay Boulevard on the east.

Area C. Recycled Water Pipeline in area C is the Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way to just beyond Oak Ridge Drive.

Area C. Conveyance Force Main in area C is the Los Osos business district roughly bounded by Los Osos Valley Road, Ferrell Avenue, Santa Ynez Avenue, and Fairchild Way to just beyond Oak Ridge Drive.

The total area where depth to groundwater is above the pipe invert for each of the project areas is summarized in Table 1.

**Table 1. Depth to Groundwater Calculations for each Project Area**

Project Area	Estimated total area where water table is above the pipe invert	Estimated total length of pipe where water table is above the pipe invert
Area A	3,500,000 sq ft	14,100 lf
Area B	4,800,000 sq ft	12,700 lf
Area C	1,800,000 sq ft	6,100 lf
Area D	1,300,000 sq ft	2,800 lf
Gravity Subtotal	11,400,000 sq ft	35,700 lf
Recycled Water Main	1,240,000 sq ft	4,200 lf
Conveyance Force Main	1,003,000 sq ft	3,400 lf
Pressure Main Subtotal	2,243,000 sq ft	7,600 lf

## 5. Dewatering Analysis

### *Assumptions:*

- The soils in the study area are a mix of alluvium and sand dune deposits. The hydraulic conductivity range of 10 ft/d to 50 ft/d was used to test the sensitivity of the calculated dewatering to this parameter.
- In addition to the uncertainty of hydraulic conductivity, the thickness of the aquifer was tested over a range of 40 to 60 feet based on site geologic data to test the sensitivity of the calculated dewatering to this parameter.
- Drawdown targets will vary depending on the depth to groundwater in the excavation depth needed for construction. As a third sensitivity test, the drawdown targets were varied from 5 to 10 feet. As mentioned above, of the pipes that will be installed below the water table, approximately ¾ of pipe inverts are less than 5 feet below the water table.
- The total area in need of dewatering at any given time was assumed to be equivalent to a circle approximately 1,250 ft in diameter. This assumption was made based on the need to dewater a two block by three block area in Area A (approximately 1,250,000 sq ft). This assumes two crews constructing one heading per area.
- The approach used to estimate dewatering flow assumes one well and a circular drawdown cone. The dewatering estimate is a planning-level guidance which must be fine-tuned with updated analysis when specific dewatering layouts and well locations are available.
- A value of 1,250 ft, or approximately double the drawdown target radius, was used for the limit of the drawdown cone in the single well calculation. In reality, the effect of dewatering may extend beyond this limit.
- The analysis assumes equilibrium conditions. The dewatering rate will vary depending on dewatering progress. Higher pumping rates will be needed at the start of dewatering. When dewatering areas closer to the coast, higher pumping rates may be needed, as more groundwater is available in these locations through inflow of seawater.

Under equilibrium conditions, the volume of water that a dewatering system will have to pump from an unconfined aquifer to produce a certain drawdown is given by<sup>1</sup>:

$$\text{Dewatering Flow (Q)} = K(H^2 - h^2) / (1055 * \log(R/r))$$

where

Q = discharge in gpm

K = hydraulic conductivity, in gpd/ft<sup>2</sup>

H = saturated thickness of the aquifer before pumping, in ft

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<sup>1</sup> From Driscoll. Groundwater and Wells, 2nd Edition. 1986

$h$  = depth of water in the well while pumping, in ft

$R$  = radius of cone depression, in ft, and

$r$  = radius of “well”, in feet.

**Table 2. Parameters Used in Dewatering Flow Calculation**

Parameter	Parameter Description	Parameter Assumptions
K	Aquifer hydraulic conductivity	10 – 50 ft/d
H	Aquifer thickness	40 - 60 ft
h	Drawdown	5 - 10 ft
R	Radius of drawdown cone	1250 ft
r	Radius of dewatered area	625 ft

Using a range of soil hydraulic conductivity (10 ft/d - 50 ft/d), and aquifer thickness of 40 – 60, with a target drawdown of 5 feet, the resulting range of dewatering is 110 to 670 gpm (160,000 gpd to 970,000 gpd) for a dewatered area of approximately 1,250,000 sq ft (a circle with radius of 625 ft based on the example above). With a target drawdown of 10 feet, the range of dewatering is increased to 200 to 1,250 gpm (300,000 gpd to 1,800,000 gpd). In general, the calculated dewatering rate increases as aquifer thickness and hydraulic conductivity increase as both changes increase the flow of water to the dewatering well.

Based on this analysis, the dewatering areas have been broken down into subareas within each gravity sewer area. These are shown in Figure 2 entitled Los Osos Sewer Areas With Shallow Groundwater.

As shown in Figure 2, Area A has been broken into four subareas:

1. A1 is located on Santa Maria Avenue from Pasadena to 4<sup>th</sup>. Estimated dewatering production is 690 to 1340 gpm.
2. A2 is located on El Morro from 4<sup>th</sup> to 8<sup>th</sup>. Estimated dewatering production is 740 to 1420 gpm.
3. A3 is located on El Morro from 8<sup>th</sup> to 11<sup>th</sup>. Estimated dewatering production is 830 to 1600 gpm.
4. A4 is located on Paso Robles from 15<sup>th</sup> to 18<sup>th</sup>. Estimated dewatering production is 620 to 1200 gpm.

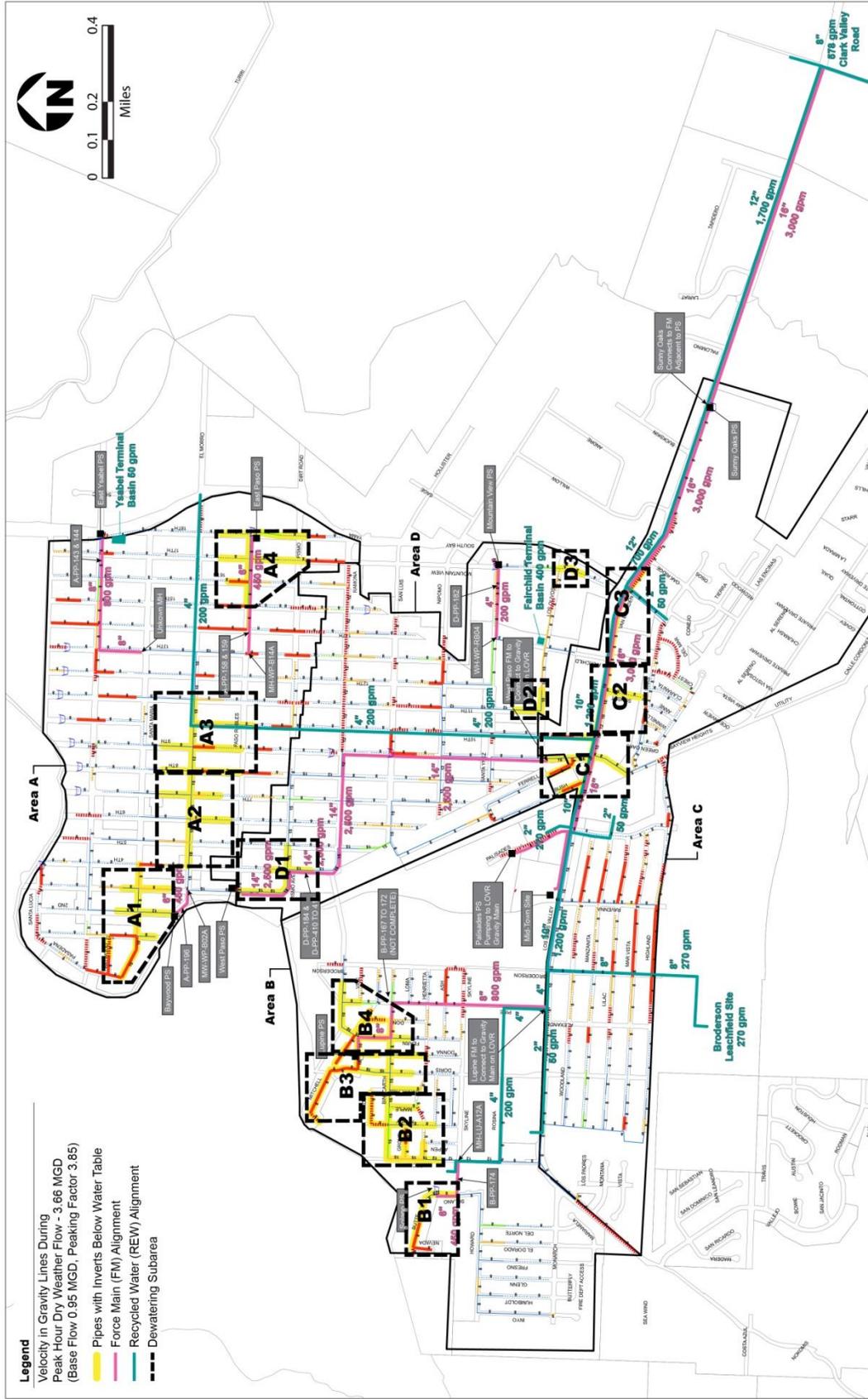


Figure 2. Los Osos Wastewater Collection System – Sewer Areas with Shallow Groundwater

Area B has been broken into four subareas:

1. B1 is located on Butte from Nevada to Solano. Estimated dewatering production is 390 to 750 gpm.
2. B2 is located on Binscarth from Pecho to Sunny Hill. Estimated dewatering production is 590 to 1140 gpm.
3. B3 is located on Mitchell to Lupine. Estimated dewatering production is 650 to 1250 gpm.
4. B4 is located on Lupine from Donna to Broderson. Estimated dewatering production is 480 to 930 gpm.

Area C has been broken into three subareas:

1. C1 is located on LOVR from Bush to 10<sup>th</sup>. Estimated dewatering production is 560 to 1100 gpm.
2. C2 is located on LOVR from 10<sup>th</sup> to Fairchild. Estimated dewatering production is 370 to 720 gpm.
3. C3 is located on LOVR from Fairchild to Oak Ridge. Estimated dewatering production is 410 to 790 gpm.

Area D has been broken into three subareas:

1. D1 is located on 3<sup>rd</sup> from Pismo and 3<sup>rd</sup> to 5<sup>th</sup> Street. Estimated dewatering production is 490 to 950 gpm.
2. D2 is located on Los Olivos from 11<sup>th</sup> to 12<sup>th</sup>. Estimated dewatering production is 140 to 270 gpm.
3. D3 is located on Mt View from Los Olivos to LOVR. Estimated dewatering production is 120 to 240 gpm.

The average dewatering production from a single area is approximately 620 to 1,300 gpm. If four separate areas which require dewatering are in construction at the same time, the resulting production for disposal could range from 2,500 gpm to 4,900 gpm.

## 5.1 Dewatering Analysis Conclusions

The drawdown needed to support excavation and construction will vary depending on the depth to groundwater in the excavation needed for construction in the area of interest. To obtain an estimate of dewatering pumping needed, a range of potential dewatering targets were evaluated, as well as sensitivity analysis on soil hydraulic conductivity and aquifer thickness. The approach used to estimate dewatering flow follows the “one large well” example and assumes one well sized to the extent of dewatering area and a circular drawdown cone. The dewatering estimate is a planning-level guidance which must be fine-tuned with updated analysis when specific dewatering layouts and well locations are available. Because the approach assumes an

equilibrium condition, higher pumping rates will be needed at the start of dewatering and will ultimately depend on how quickly the area needs to be fully dewatered.

## 5.2 Dewatering Analysis Limitations

Due to the wide range of unknowns in the calculation, the dewatering analysis estimates are very rough planning numbers. The following factors could impact the dewatering estimates:

- Soil conditions (hydraulic conductivity, aquifer thickness) much different than assumed values
- Initial flow rates during start of dewatering may be greater
- Boundary inflows along the coast
- Water table elevations that are significantly different from the 1999 – 2003 data used in this study, including possible impacts of land use changes, seasonal variability, etc. Data collected by Fugro in December 2011 suggests only slight differences in head compared to 2004 but the recent sampling was limited to 12 well locations.
- Construction phasing and extent of area dewatered at any one time.

The dewatering contractor will need to perform a field pumping test to confirm expected dewatering flows.

## 6. Pipeline Dewatering System

On the basis of the groundwater conditions encountered at the site, dewatering will be needed to construct the pipeline trenches in areas with shallow groundwater. The contractor should be responsible for selecting the method of dewatering, and for maintaining the dewatering system, as-needed, to allow for the pipeline construction. Dewatering should consist of lowering groundwater levels to at least 2 feet below the bottom of the trench prior to excavation. Dewatering should be performed such that water does not seep through side walls of the trench, and is significantly below the invert of the pipe to allow for stabilization of the subgrade and compaction of the pipe zone bedding material. Dewatering facilities, such as sump pits, wells, and well points should be designed with filters such that sand and fine-grained materials are not removed from the soil during dewatering operations. Dewatering facilities should be installed in advance of beginning excavation, and time should be allowed for lowering of the groundwater table before beginning excavation.

Construction dewatering and trench shoring are the likely means and methods defined and selected by the Contractor to provide a stable excavation for the construction of the proposed pipelines and pump stations. Dewatering will remove groundwater from trench and structure excavations where the bottom of the excavation is below the groundwater table. The construction dewatering methods selected by the Contractor may include dewatering pumps in sumps located in the bottom of the excavations and/or wells or well points along the perimeter of the excavations. Alternatives for disposal of construction dewatering are discussed below.

The dewatering system and shoring system work together to provide the following minimum project requirements:

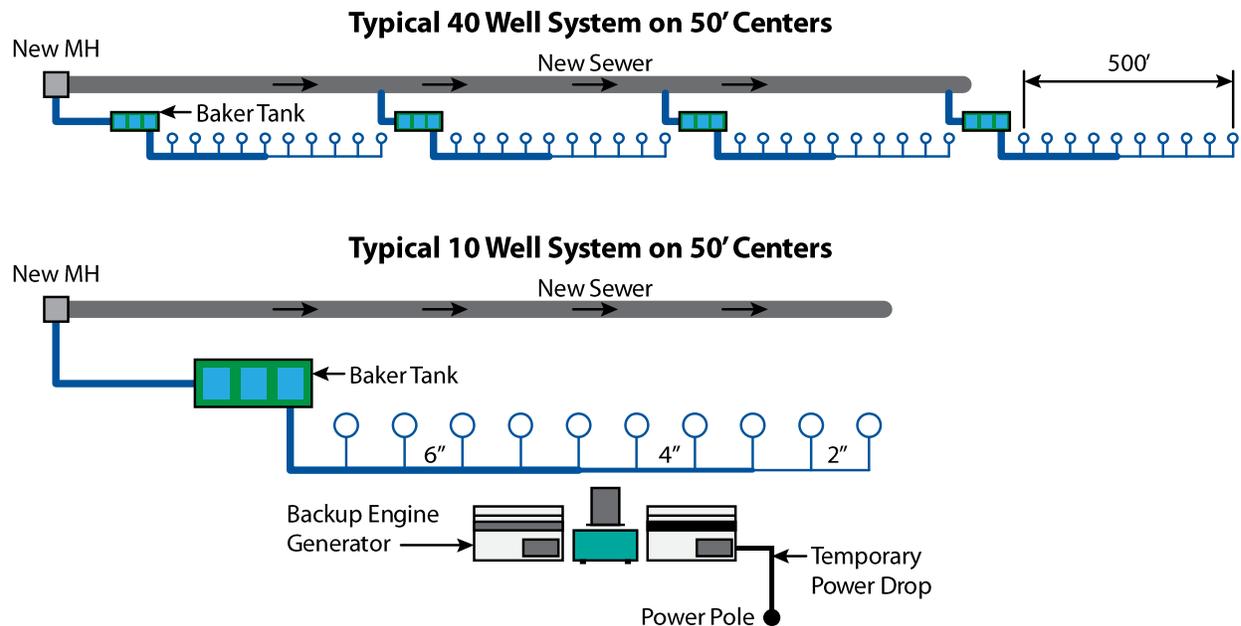
1. Provide stable excavation walls and bottom.
2. Provide reasonably dry base of excavation.
3. Filter native soil and prevent loss of ground through dispersion and erosion.
4. Prevent piping (boiling) of the excavation bottom.
5. Preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation.
6. Where shoring is not designed to resist hydrostatic pressure, the dewatering system shall draw down the groundwater level below and beyond the excavation sidewalls.
7. Where shoring is not designed to resist hydrostatic pressure, the Contractor will provide monitoring wells located midway between dewatering points to demonstrate that groundwater level is lowered as required.
8. Speed shores and trench box shoring in flowing ground conditions will not be allowed. The 2004 Fugro Geotechnical Report recommends dewatering in advance of the excavation or continuous tight shoring in areas of shallow groundwater.

In addition, the shoring system will be designed by the Contractor to protect personnel that enter the excavations and protect adjacent existing utilities, pipelines, and structures. There are several different shoring systems that define the type of dewatering system required. The shoring systems are generally classed as an active shoring system which provides full support of trench wall during excavation since the shoring is predriven or a passive shoring system which is installed after the excavation is complete. At one extreme is an active shoring system using interlocked steel sheet piles that would require minimum external dewatering since the length of the shoring would provide sufficient depth of toe embedment to provide lateral stability at the bottom of the shoring system and prevent heave and boiling through the base of the excavation. At the other extreme, is a passive shoring system such as a trench box or speed shores that would require a very aggressive dewatering system to provide a stable excavation and enough stand-up time after the excavation is completed but prior to the installation of the shoring system. Interlocked sheet piling would be too expensive since installation is slow and the sheet piles would have to be burned off and abandoned in place to prevent vibration damage to the new pipe and adjacent structures. The stand-up time of the dune sands is so short that there would not be enough time to allow trench boxes or speed shores. The test pits dug by Fugro indicated that the dune sand was typically loose and readily caved into the excavation. We would anticipate that in areas of shallow groundwater an unshored excavation would collapse before the passive shoring could be installed.

The shoring system that will probably be proposed by the Contractor is a slide-rail system that is a compromise between an active shoring system and a passive shoring system since the shoring system elements are driven into the ground as the excavation is advanced. This will require a

reasonable dewatering system with wells drilled along the pipeline alignment. The wells discharge into a collector pipeline that discharges into a Baker tank for settlement of separation of any sediment and water quality monitoring if required. The overflow discharge from the Baker tank is pumped to the disposal site. If the disposal site is the storm drains, then disinfection may be required (chlorination with hypochlorite and dechlorination with sodium bisulfite). If the disposal site is land disposal such as retention basins or the Broderon site, we anticipate that no disinfection or monitoring would be required. As discussed below, the new gravity sewers, the new pump station wet wells with temporary pumps provided by the Contractor, and the new force mains that will be used as the temporary infrastructure necessary convey the dewatered groundwater to disposal sites.

The typical pipeline dewatering system: including the wells, discharge pipeline, and Baker tanks to settle discharge to the disposal pipeline are shown in Figure 3. The dewatering pumps will be electric motor driven and, for normal operation, served by the local electrical utility with a local power drop from the existing overhead power. The Contractor may provide portable engine-generator sets to maintain standby electrical power in the event of a power outage. To minimize construction noise in the residential neighborhoods, the engine-generator sets will not be allowed to operate when service from the electrical utility is available.



**Figure 3. Typical Dewatering System**

We have assumed that the Contractors will have at least two pipeline crews in construction at two parallel streets in each collection system area.

In Area A, for example, as the pipe laying progresses from East Ysabel Avenue south to El Morro Avenue, one dewatering crew would begin work on one of the parallel north-south streets such as Pasadena or 1st Street and proceed south from East Ysabel to El Morro while the second

dewatering crew would begin work on 3<sup>rd</sup> Street or 4<sup>th</sup> Street at East Ysabel and proceed south to El Morro, and then fill in the east-west portion on Santa Maria Avenue. Once the potholing and utility clearance has been approved, the drilling subcontractor will install and develop the dewatering wells. After the area from East Ysabel Avenue south to El Morro Avenue has been dewatered for several days and it has been confirmed that the groundwater has been pumped down to a depth at least two feet below the bottom of the trench excavation, the trench excavation will begin on Pasadena, 1<sup>st</sup> Street, 2<sup>nd</sup> Street, 3<sup>rd</sup> Street and 4<sup>th</sup> Street proceeding south from East Ysabel Avenue to El Morro Avenue and west on Santa Maria from 4<sup>th</sup> Street to Pasadena. After the pipelines have been installed, the trench backfilled and compacted, the pipe tested, and temporary pavement installed, groundwater pumping will continue for several days. In the meantime, the dewatering well installation will relocate to El Morro Avenue at 4<sup>th</sup> Street and start the entire dewatering, pipe installation, and temporary pavement restoration process again from Santa Maria south to Paso Robles on 5<sup>th</sup>, 6<sup>th</sup>, and 7<sup>th</sup> Streets. Once the second subarea is completed, the dewatering well installation will relocate to El Morro Avenue at 10<sup>th</sup> Street and start the process again from Santa Maria south to Paso Robles on 8<sup>th</sup>, 9<sup>th</sup>, and 10<sup>th</sup> Streets. Once that third subarea is completed, the dewatering well installation will relocate to Paso Robles Avenue at 18<sup>th</sup> Street and start the process again from El Morro south to Pismo Avenue. The geotechnical report indicates that the depth of the groundwater will be below the bottom of the trench in the other portions of Area A. We are assuming that dewatering with an occasional sump pump in the bottom of the trench would keep the excavation dry in these sections of Area A.

### 6.1 Drilling Methods and Well Development Techniques.

We anticipate that the following will occur prior to discharging into the new sewer pipe for temporary disposal.

The driller will drill a 24" diameter borehole, set an 8" diameter commercially slotted casing (depths vary); backfill the borehole around the casing with a clean, washed pea gravel sand mixture in the annular space and set a dewatering pump. The driller will then develop the well by pumping, overpumping, bailing and backwashing to obtain a clear, artifact-free water from the formation. The procedure involves pumping from well to well to complete the development process. The last well will be developed into the sand sediment tank (Baker tank).

Once the well has been developed, it is plumbed into the discharge line and run to a sand sediment tank, before it reaches the final discharge point. The well filter pack remains in an undisturbed state throughout the daily 24 hour per day dewatering process. During the developmental stage of the well, the fines are removed through the well filter pack and resulting discharge will be sediment free.

However, if a well is turned off for a period of time and then turned back on, there will be a small amount of color to the discharge water caused by the increased entrance velocity of the water stored around the well. Once the stored water has been removed and the well is only controlling the influx of water, the water will be clear, sediment and color free. Inspection of the discharge, after two hours, should result in a clear, sediment free discharge.

## 7. Groundwater Disposal Alternatives

Various construction dewatering disposal methods have been evaluated including: 1) surface disposal; 2) construction use to minimize discharge; 3) land disposal; 4) storm drain discharge; 5) Broderson leachfield site; 6) Mid-Town groundwater retention site; 7) sprayfields; 8) agricultural reuse; 9) a combination of disposal to the Broderson leachfield site and agricultural reuse; and 10) a combination of disposal to the Mid-Town retention site and the Broderson leachfield site. Each alternative was evaluated for: 1) level of effort; 2) relative cost to the project; and 3) estimated quantity of water that can be disposed of.

### 7.1 Surface Disposal

Surface disposal directly to Los Osos Creek tributaries, such as Willow Creek (South Bay Boulevard and Santa Ynez) or Walker Ditch (Paso Robles and 18<sup>th</sup>) or Morro Bay may not be feasible for several reasons. First, Morro Bay is a National Estuary that is being managed for the long-term protection of its fragile natural resources; discharging potentially contaminated groundwater to this estuary would conflict with this long-term environmental protection program. Similarly, Los Osos Creek discharges directly to Morro Bay and provides habitat for several special status species including Southern Steelhead. Los Osos Creek is managed as a SRA and as wetlands under the jurisdiction of the USACE, RWQCB and CDFG. The RWQCB discharge requirements for both water bodies include monitoring requirements and discharge limits for a range of constituents. Surface water disposal directly to Morro Bay or Los Osos Creek and its tributaries is an option for Contractors, however the risk of costly monitoring and treatment requires other options to be considered.

### 7.2 Construction Use Discharge Minimization

Where feasible, the water will be utilized by the Contractor for earthwork compaction and dust control. Such construction use will preserve potable water sources for domestic use and reduce the total discharge requirements. This would eliminate a portion of the construction dewatering but the bulk of the water would need to be disposed of in other locations. The estimated quantity of water that could be disposed of through auxiliary construction use is only about 5,000 gallons per day (gpd) per construction area since the water will have to be pumped to an elevated temporary storage tank and spread as needed by a water truck. The Contractor will be required to post signs to minimize direct human contact with the construction water since it is non-potable and has not been disinfected. The estimated quantity of construction water consumed at 5,000 gpd per construction area equates to 3.5 gallons per minute (gpm). Construction use will be required throughout construction. However, this is a very small volume compared to the total anticipated range of construction dewatering production.

### 7.3 Mid-Town Retention Site (Former Water Treatment Plant Site)

The Mid-Town site is being restored as a separate project and will include a retention basin with a capacity of 11,100 gpm (16 million gpd) with a safety factor of 2 and 5,600 gpm (8.1 million gpd) with a safety factor of 4 based on an estimated percolation rate of 180 gpd/sf per discussions with Jon Blanchard with Fugro West, Inc. Geotechnical Engineers. Dewatering discharges to this site are allowed under project permits and its use by Contractors is encouraged. Based on the geologic cross sections presented in the 2004 report, the groundwater in this area is approximately 25 to 40 feet below ground surface. The soils underlying the site are

made up of a 10- to 15-foot layer of dune sand located above the Paso Robles Formation, which is made up of medium to dense sands and silty sands. Approximately, four acres of the 11.6 acre site will be available for the stormwater retention facility.

#### 7.4 Broderson Leachfield Site

According to the 2004 Fugro Geotechnical Report, approximately 8 acres of the 81-acre Broderson site is suitable for a leachfield. The report summarizes several prior analyses that evaluated the Broderson leachfield hydraulic capacity. The report states that the percolation capacity of the Broderson site is 810,000 gpd. Therefore, the estimated quantity of water that might be disposed of at the Broderson leachfield site is 560 gpm (810,000 gpd). The Area C contractor is responsible for installing the Broderson leachfield site and the REW force main from the Mid-Town PS to the Broderson site.

#### 7.5 Retention Basins

There are publicly and privately owned stormwater retention basins within the project area. Where practical, the Contractor may utilize these facilities for the disposal of construction dewatering water without requirements for sediment removal and disinfection criteria. The Contractor will be encouraged to negotiate the use of private retention basins. The estimated quantity of water that might be disposed of through public retention basins is about 50 gpm (72,000 gpd) for the Ysabel Terminal Basin and about 400 gpm (576,000 gpd) for the Fairchild Terminal Basin.

#### 7.6 Storm Drain Discharge

Disposal to storm drains and stormwater pumping stations leads directly to regulated surface waters and will likely require pretreatment to remove sediments and silts, disinfection (chlorinated with hypochlorite and dechlorinated with sodium bisulfate) and frequent water quality monitoring and reporting to the RWQCB. Specification Section 02140 defines several storm drain pipelines and channels that could be used for disposal. The estimated combined capacity of the Lupine Stormwater Pump Station wetwell, the 8<sup>th</sup> and El Morro Stormwater Pump Station wetwell, and the Walker Ditch is about 5,300 gpm (7,600,000 gpd).

#### 7.7 Sprayfields

Sprayfield disposal is the practice of spraying the construction dewatering discharge on land to dispose of the water through evapotranspiration and percolation. It is assumed that disinfection would be required due to the potential for air-borne contact with potentially contaminated groundwater. For this reason, sprayfield disposal has been dropped from further consideration.

#### 7.8 Agricultural Reuse

Agricultural reuse consists of using construction dewatering discharge to irrigate agricultural crops. According to the California Department of Public Health Title 22, California Code of Regulations Division 4, Chapter 3, Section 60304, certain crops such as fodder and fiber crops, sod, and ornamentals, can be irrigated with secondary effluent. This could be extended to non-disinfected groundwater for irrigating non-fodder crops and grasses. Several sites that were considered for agricultural reuse for the WWTP Effluent Disposal have been identified in the Carollo Effluent Disposal Alternative Evaluation.

Some advantages of agricultural reuse are that it increases available local water supplies on a short term basis and it allows farmers to reduce groundwater pumping from present levels. One disadvantage is that agricultural reuse is seasonal and would only be feasible during the dry season.

Agricultural reuse can be implemented only if existing farmers agree to use the construction dewatering for irrigation. Contractors are encouraged to negotiate use of private agricultural land for dewatering disposal. The estimated quantity of water that could be discharged to irrigation depends on the amount of land available for use. This may not be a realistic alternative for augmenting the Broderson leachfield site disposal.

### **7.9 Combining Broderson Site Disposal/Agricultural Reuse Alternatives**

Combining disposal to the Broderson leachfield system augmented with agricultural irrigation is a cost effective method for disposing the construction dewatering and would provide additional flexibility. The resulting disposal capacity would be 560 gpm (810,000 gpd) which is below the minimum estimated groundwater disposal requirement of 620 gpm (893,000 gpd). A serious disadvantage of this alternative is that the pipeline and leachfield infrastructure must be in place and operational before either the Broderson site or the agricultural reuse can be implemented. And as discussed previously, the agricultural use agreement must be finalized before the agricultural reuse can be made available.

### **7.10 Combining Mid-Town Retention Site/Broderson Site Disposal Alternatives**

Combining disposal to the Mid-Town retention site augmented with the Broderson leachfield system is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 6,000 gpm (8.6 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

### **7.11 Combining Mid-Town Retention Site/Public Retention Basin Site Disposal Alternatives**

Combining disposal to the Mid-Town retention site augmented with the existing public retention basin sites is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 5,900 gpm (8.5 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

### **7.12 Combining Public Retention Basin Sites/Broderson Site Disposal Alternatives**

Combining disposal to the Public retention basin sites augmented with the Broderson leachfield system is the most cost effective method for disposing of the construction dewatering water and

would provide additional flexibility. The resulting disposal capacity would be approximately 960 gpm (1.4 million gpd) which meets and exceeds the minimum estimated groundwater disposal requirement of 620 gpm (893,000 gpd) for a single dewatering area but is well below the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single area or the 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

### 7.13 Combining Mid-Town Retention Site/Public Retention Basin Sites/ and Broderson Site Disposal Alternatives

Combining disposal to the new Mid-Town retention site, the existing public and private retention basin sites augmented with the Broderson leachfield system is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 6,000 gpm (8.6 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas.

### 7.14 Combining Mid-Town Retention Site/Public Retention Basin Sites/Broderson Site/ and Ag Reuse Disposal Alternatives

Combining disposal to the Mid-Town retention site, the existing public retention basin sites, augmented with the Broderson leachfield system and agricultural reuse irrigation is a cost effective method for disposing of the construction dewatering water and would provide additional flexibility. The resulting disposal capacity would be approximately 6,000 gpm (8.6 million gpd) which meets and exceeds the maximum estimated groundwater disposal requirement of 1,300 gpm (1.9 million gpd) for a single dewatering area and exceeds the maximum estimated groundwater disposal requirement of 4,900 gpm (7 million gpd) for concurrent dewatering from four different areas. As discussed previously, the agricultural use agreement must be finalized before the agricultural reuse can be made available.

### 7.15 Dewatering Disposal Alternative Analysis

As developed in the dewatering analysis, the estimated disposal requirements vary depending on the type of soils encountered and the depth of the groundwater. Table 3 summarizes the dewatering disposal alternative analysis.

**Table 3. Dewatering Disposal Alternative Analysis to Meet Maximum Demand (2,530 to 4,900 gpm)**

	Alternative	Description	Relative Cost	Estimated Capacity GPM	Level of Effort	Benefits/Disadvantages
1	Construction use	Dust control, compaction. No disinfection	\$	3.5	Minor	CDP Condition / Only uses small amount of GW.
2	Mid-Town retention site	No disinfection No settlement.	\$\$	5,500	Minor	Uses large volume of GW. / Inclement weather and rain runoff restricts use.
3	Broderson leachfield site	Settle first. No disinfection.	\$	560	Reasonable	Not restricted by weather. Available for use year round/ Broderson leachfield and pipe must be built first.

**Table 3. Dewatering Disposal Alternative Analysis to Meet Maximum Demand (2,530 to 4,900 gpm)**

	Alternative	Description	Relative Cost	Estimated Capacity GPM	Level of Effort	Benefits/Disadvantages
4	Public retention basins	No disinfection and no settlement.	\$\$	450	Minor	Uses large volume of GW but rain runoff restricts use.
5	Storm drain	Settle first and Disinfect.	\$\$\$\$	5,300	High	Uses large volume of GW but inclement weather and rain runoff restricts use.
6	Agricultural reuse (irrigation)	Settle first. No disinfection.	\$	Depends on area available	High	Broderson pipeline to WWTP must be built first/Ag reuse is seasonal.
7	Combining Broderson site and Agricultural reuse	Settle first. No disinfection.	\$	>560	High	Broderson not restricted by weather. / Broderson leachfield site and pipeline must be built first./ Ag reuse is seasonal.
8	Combining Mid-Town retention site and Broderson site	No disinfection. Mid-Town – no settlement. Broderson - settlement.	\$	6,000	Reasonable	Broderson not restricted by weather. Available for use year round/ Broderson leachfield site and pipeline must be built first. Mid-Town weather restricted.
9	Combining Mid-Town and Public retention sites	No settlement. No disinfection.	\$	5,900	Reasonable	Minimal infrastructure to use. / Restricted by weather.
10	Combining Public retention sites and Broderson site	Settle first. No disinfection.	\$	960	Reasonable	Not restricted by weather. Available for use year round/ Broderson leachfield site and pipeline must be built first.
11	Combining Mid-Town and Public retention sites and Broderson site	Settle first. No disinfection.	\$	6,500	Reasonable	Broderson is not restricted by weather, available for use year round/ Broderson leachfield site and pipeline must be built first. / Retention sites are restricted by weather.
12	Combining Mid-Town and Public retention sites Broderson site and Ag Reuse	Settle first. No disinfection.	\$	>6,500	High	Broderson is not restricted by weather, available for use year round/ Broderson leachfield site and pipeline must be built first/Ag reuse is seasonal.

### 7.16 Conveyance Infrastructure Required to Use Mid-Town Retention Site

It may be feasible to utilize the new gravity sewers, pump station wet wells, force mains, and recycled water pipelines as soon as these facilities are completed to convey the dewatering water to disposal at the Mid-Town retention site. This section summarizes by project area what new infrastructure would need to be in place to dispose of the dewatering water in the Mid-Town stormwater retention basin and the existing adjacent public and private basins.

Figure 4A through 4D shows the Los Osos Collection System and the routing of the conveyance force main (FM) to the WWTP and the recycled water (REW) pipeline from the WWTP just north

of Los Osos Valley Road at Clark Valley Road. The figure also shows the location of the Mid-Town Site, Ysabel Terminal Basin, the Fairchild Terminal Basin, the Broderson Leachfield Site, and the Clark Valley Road agricultural reuse area.

In Figure 4A through 4D, pipelines with invert below the water table are highlighted in yellow in each of the four gravity sewer areas. The total area in need of dewatering at any given time was assumed to be equivalent to a circle approximately 1,250 ft in diameter. This assumption was made based on the need to dewater a two block by three block area in Area A (approximately 1,250,000 sq ft). The estimated groundwater disposal requirement is approximately 620 to 1,300 gpm (893,000 to 1.9 million gpd) within the two block by three block dewatered zone. The new infrastructure that would need to be in place to dispose of the dewatering water in the Mid-Town site is highlighted in purple in each of the four gravity sewer areas.

### Area A

Figure 4A shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area A. Area A has very few retention basins available for groundwater disposal. As a result, the initial phases of construction will require stage 1 groundwater disposal relying on construction use and treatment and disposal to the storm drainage system until the Baywood PS and West Paso PS wet wells, the interconnection gravity sewers and the 6-inch Baywood force main, the 14-inch West Paso force main, the 16-inch gravity sewer on 9<sup>th</sup> Street, the 16-inch gravity sewer on LOVR, and the Mid-Town PS wet well are constructed and operational. The West Paso force main discharges to the 16-inch gravity sewer at Los Olivos and 9<sup>th</sup> Street. As a result, the 16-inch gravity sewer on 9<sup>th</sup> Street and the 16-inch gravity sewer on LOVR must also be constructed to convey groundwater to the Mid-Town PS wet well.

In subarea A1, the Contractor could use the new gravity sewer to convey water to the Baywood PS located on 2<sup>nd</sup> at El Morro Avenue. Baywood PS has a wet well capacity sufficient for the 380 gpm pump. The additional wetwell pumping capacity required to move the 690 to 1,340 gpm dewatered flow from area A1 would range from 310 to 960 gpm. However, the 6-inch Baywood PS FM discharges into the 18-inch gravity sewer at 3<sup>rd</sup> and El Morro Avenue which feeds to the West Paso PS wetwell in Area D. The West Paso PS discharges into a 14-inch FM which has a capacity of 2,500 gpm. The West Paso PS wetwell has a capacity of 1,500 gpm. Once constructed, the 14-inch FM runs south through Area D down 3<sup>rd</sup>, Pismo, 4<sup>th</sup>, Ramona, and 9<sup>th</sup> Street where it discharges into a gravity sewer manhole at Los Olivos. This 16-inch gravity sewer runs south on 9<sup>th</sup> Street to LOVR where it connects to the 16-inch gravity sewer flowing into Mid-Town Pump Station. To use the Fairchild Terminal Basin and the Mid-Town retention basin, both the Baywood PS and the West Paso PS wet wells and the entire length of the 14-inch force main from West Paso PS to Los Olivos Street would need to be installed by the Area D Contractor, and the 16-inch gravity sewer in LOVR from 9<sup>th</sup> Street west to the Mid-Town site, and the Mid-Town PS wet well would need to be installed by the Area C Contractor. Subareas A2, A3, and A4 would similarly require that the Area D force main from West Paso PS and the gravity sewer on 9<sup>th</sup> Street and the Area C gravity sewer on LOVR and the Mid-Town PS wet well would need to be installed to convey the dewatered flows to Fairchild Terminal Basin and the Mid-Town site.



## Area B

Figure 4B shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area B. As in Area A, Area B has very few retention basins available for groundwater disposal. Figure 3B shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area B. The initial phases of construction will require stage 1 groundwater disposal relying on construction use and treatment and disposal to the storm drainage system until the Solano PS and Lupine PS wet wells, the interconnecting gravity sewer, the 8-inch Lupine PS force main and the gravity sewer on LOVR are complete, allowing dewatering water to be conveyed to the Mid-Town retention site. The Area B contractor will start construction in Subareas B1, B2, B3, and B4 by building the wet wells at Solano PS and Lupine PS. Once the two wet wells are constructed the intent will be to use the new gravity sewers as they are constructed to convey the dewatering water to the two pump station wet wells.

In subarea B1, the Contractor could use the new gravity sewer to convey water to the Solano PS located on Butte at Solano Avenue. Solano PS has a wet well capacity sufficient for the 168 gpm pump. However, the 6-inch Solano PS FM discharges into the 12-inch gravity sewer at Pecho Road and Skyline Avenue which feeds to the Lupine PS. The additional wetwell pumping capacity required to move the 390 to 750 gpm dewatered flow from area B1 would range from 220 gpm to 580 gpm. To convey the dewatered flows from subarea B1 to the Lupine PS wetwell, the entire length of the gravity sewer on Pecho Road, Binscarth, and Doris would need to be installed by the Area B Contractor. Lupine PS has a wet well capacity sufficient for the 623 gpm pump. The 8-inch Lupine PS FM discharges into the 10-inch gravity sewer on LOVR which feeds to the Mid-Town PS wet well. To use the Fairchild Terminal Basin and the Mid-Town retention basin, the Solano Paso PS wetwell, the Lupine PS wetwell, and the entire length of the gravity sewer on Pecho Road, Binscarth, and Doris, and the 8-inch Lupine FM would need to be installed by the Area B Contractor, and the 16-inch gravity sewer in LOVR from 9<sup>th</sup> Street west to the Mid-Town site and the Mid-Town PS wet well would need to be installed by the Area C Contractor. Subareas B2, B3, and B4 would similarly require that the Area B force main from Lupine PS and the Area C gravity sewer on LOVR and the Mid-Town PS wet well would need to be installed to convey the dewatered flows to Fairchild Terminal Basin and the Mid-Town site. However, the capacity of the Lupine FM is only about 800 gpm, so additional dewatering flows would have to be pumped into a temporary pipeline to carry these additional flows to the LOVR gravity sewer at Pine Street and LOVR.



### Area C

Figure 4C shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area C. Area C has the Mid-Town retention site and several private retention basins. In subarea C1, the Contractor could use the new gravity sewer to convey water to the Mid-Town site. To use the Mid-Town retention basin, the 16-inch gravity sewer in LOVR from 9<sup>th</sup> Street west to the Mid-Town site and the Mid-Town PS wet well would need to be installed by the Area C Contractor. To convey dewatered flows by gravity from subarea C2, the Contractor would need to install the 12- and 16-inch gravity sewers on LOVR to the Mid-Town PS wet well. To convey dewatered flows by gravity from subarea C3, the Contractor would need to install the 8-, 10-, 12-, and 16-inch gravity sewers on LOVR from 10<sup>th</sup> Street to the Mid-Town PS wet well. To utilize the Fairchild Terminal Basin, Subareas C1, C2 and C3 the Contractor would probably use a temporary pipeline to convey pumped dewatered flows the short distance from LOVR to the Fairchild Terminal Basin on Los Olivos Road.

### Area D

Figure 4D shows the dewatering disposal conveyance infrastructure needed for groundwater disposal in Area D. Area D has a large public retention basin called the Fairchild Terminal Basin with an estimated infiltration capacity of about 400 gpm available for groundwater disposal. Dewatering disposal flows in excess of 400 gpm will need to be conveyed to the Mid-Town retention site.

In subarea D1, the Contractor could use the new gravity sewer to convey water to the West Paso PS located on 3rd at Paso Robles Avenue. West Paso PS has a wet well capacity sufficient for the 1,550 gpm pumps. No additional wetwell pumping capacity required to move the 490 to 950 gpm dewatered flow from area D1. To convey dewatered flows to the Mid-Town retention basin, the West Paso PS wetwell and the entire length of the 14-inch force main from West Paso PS to Los Olivos Street would need to be installed by the Area D Contractor, and the 16-inch gravity sewer in LOVR from 9<sup>th</sup> Street west to the Mid-Town PS wet well and the Mid-Town site would need to be installed by the Area C Contractor. To move Subarea D1 flows to the Fairchild Terminal Basin the Contractor would probably use a temporary pipeline on Los Olivos to convey the dewatered flows the four blocks from 9<sup>th</sup> Street to the Fairchild Terminal Basin. Subareas D2 and D3 would probably use a temporary pipeline to convey the dewatered flows the short distance to the Fairchild Terminal Basin.

## 7.17 Conveyance Infrastructure Required to Use Broderson Leachfield Site

It may be feasible to utilize the new gravity sewers, pump station wet wells, force mains, and recycled water pipelines as soon as these facilities are completed to convey the dewatering water to disposal at the Broderson leachfield site. This section summarizes by project area what new infrastructure would need to be in place to dispose of the dewatering water in the Broderson leachfield site.

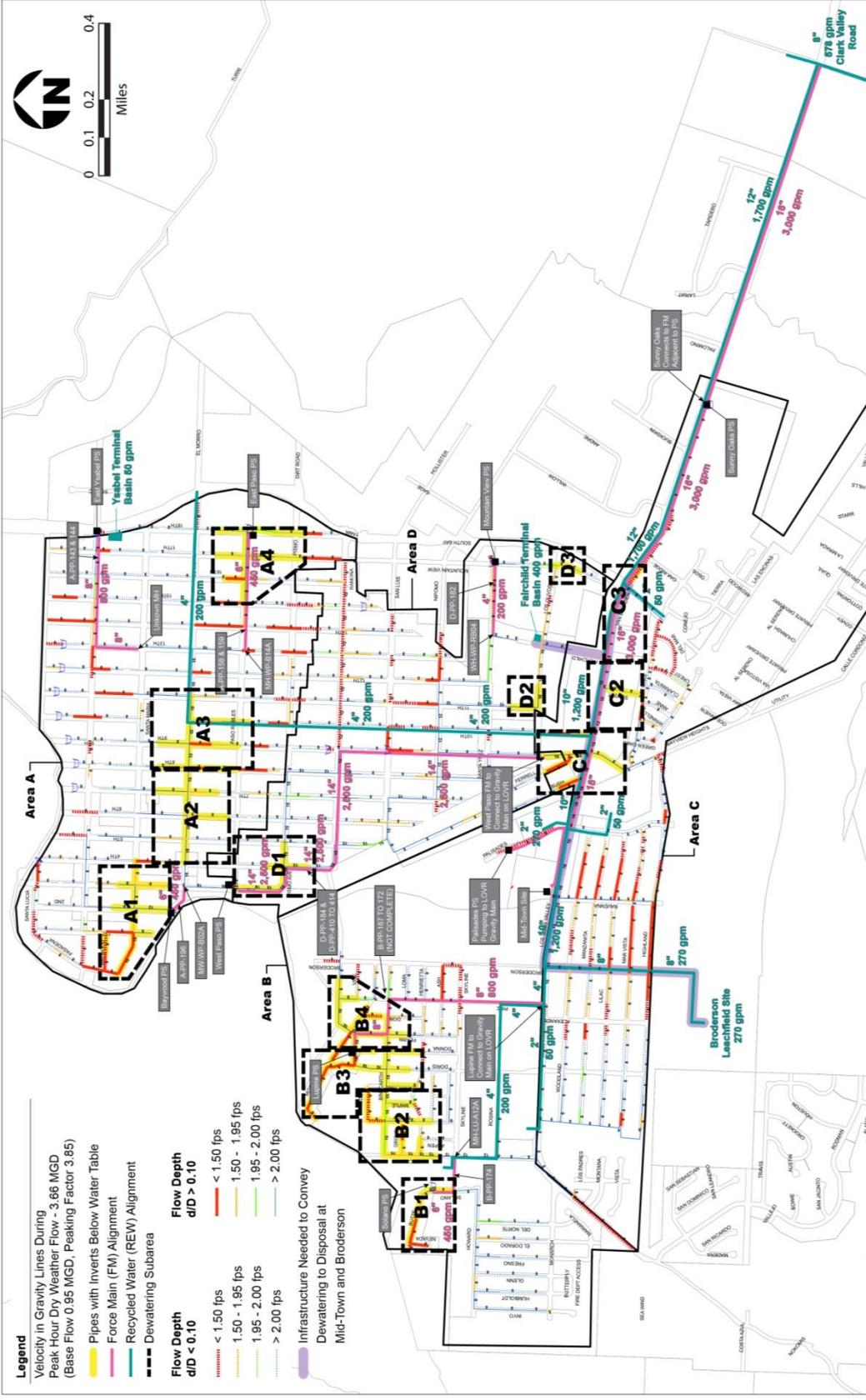
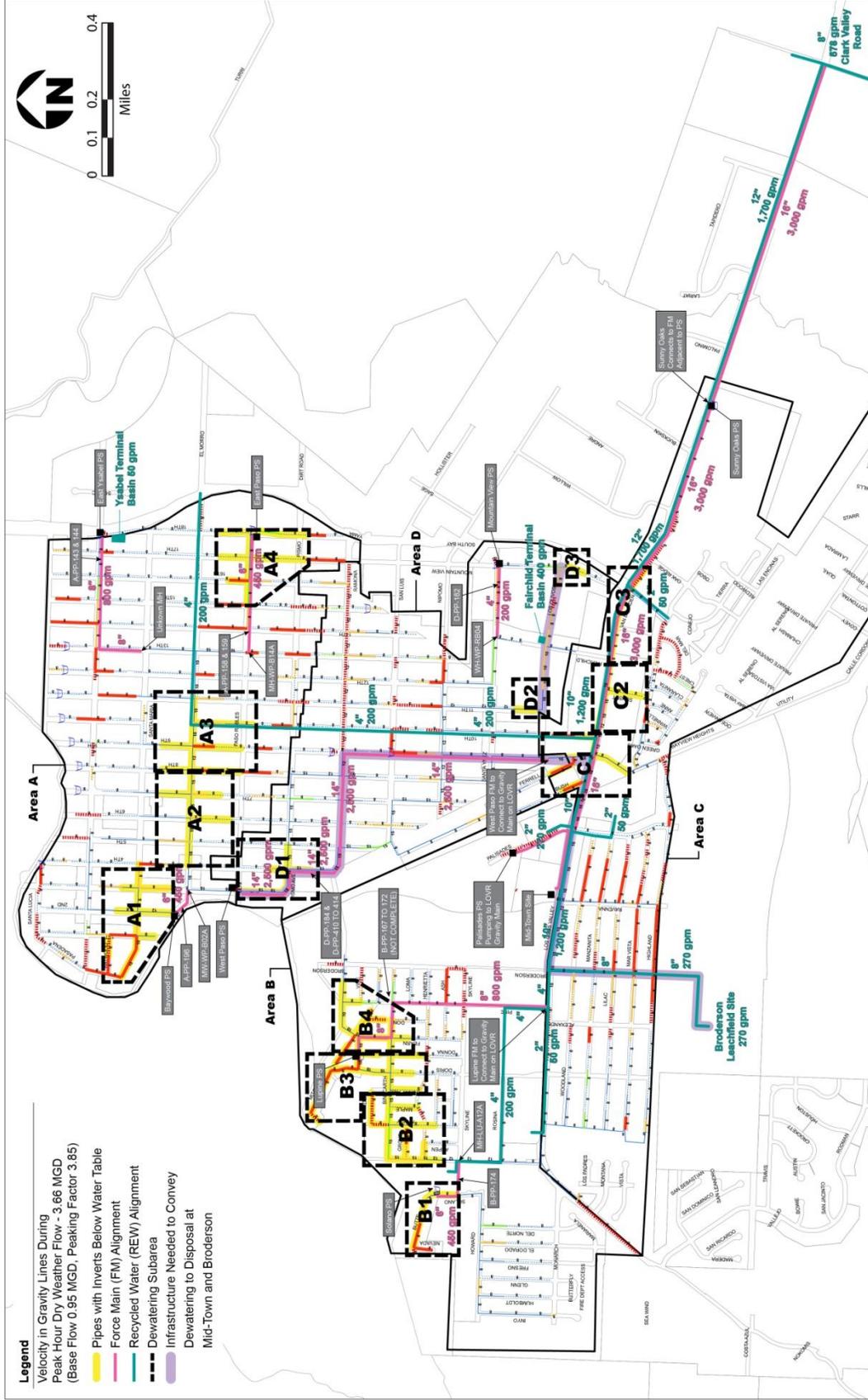


Figure 4C. Los Osos Wastewater Collection System – Area C Dewatering Disposal Conveyance Infrastructure



As described before, figure 4A through 4D show the Los Osos Collection System and the routing of the conveyance force main (FM) to the WWTP and the recycled water (REW) pipeline from the WWTP just north of Los Osos Valley Road at Clark Valley Road. The figures also show the location of the Mid-Town Site, Ysabel Terminal Basin, the Fairchild Terminal Basin, the Broderson Leachfield Site, and the Clark Valley Road agricultural reuse area.

The Contractor could use the new REW force main and the Mid-Town PS wet well to convey water to the Broderson leachfield site. To use the Broderson site, the Area C contractor must install the leachfield infiltration system, the perforated percolation piping, and the control valves and vaults. The 10-inch REW from the Mid-Town PS would need to be installed in LOVR from Ravenna Avenue to Broderson Avenue and the 8-inch REW would need to be installed from LOVR to the Broderson site. These facilities must be installed, tested and operational before Broderson can be put in temporary service for groundwater disposal. In addition, it may be necessary to install the five monitoring wells to monitor groundwater depth and performance of the leachfield.

Disinfection will not be required for groundwater disposal at the Broderson site. However, the Contractor must remove any sediment in the dewatering water to prevent clogging. If the pores beneath the leachfield become clogged over time, the leachfield would have to be excavated, the ground beneath it ripped or disked and the leachfield reconstructed.

## 8. Recommended Approach

CDM Smith's preliminary recommendation is to implement a four-stage approach. The first stage is to use construction use and treatment since no groundwater retention sites will be available when work starts. Stage two would utilize construction use and the new Mid-Town retention site and the existing retention basin sites for groundwater disposal while the Broderson leachfield system and the recycled water pipeline from the treatment plant to the Broderson Effluent Disposal site are being constructed. The current plan is to bid gravity sewer areas A and D together with the Area A and D pump station wet well construction as the first bid package. Gravity sewer areas B and C will be bid together with the Area B and C pump station wet well construction. The gravity sewer construction on LOVR will be defined as an early construction milestone. The pump station installation will be bid separately. During stage three, when the Broderson leachfield site and the recycled water pipeline have been constructed, both the Mid-Town retention site and the Broderson leachfield site will be operational and construction of the gravity collection system and pump stations and force mains can then proceed with the necessary dewatering. The intent would be to pump discharged groundwater to the Mid-Town and public retention basins for land disposal and Broderson for back-up. Disposal to Mid-Town and existing public retention sites augmented with the Broderson leachfield site appears to be a viable and cost-effective means to dispose of the anticipated groundwater disposal range (approximately 620 to 1,300 gpm for one dewatering area, and 2,500 to 4,900 gpm for four concurrent areas) throughout construction. Groundwater production in excess of 6,500 gpm would require a fourth stage involving agricultural reuse along Clark Valley Road. This would be necessary only if the groundwater production exceeds what could be disposed of with the combined capacity of the construction use + Mid-Town and existing retention sites + Broderson leachfield site. Treatment and disposal to the storm drains will always be an optional disposal method.

It is critical that the approach be revisited once construction dewatering begins. Because the amount of dewatering pumping needed will drive the need for additional disposal sites, the projected planning-level pumping rates presented in this document should be either confirmed or adjusted based on the field results. If construction conditions are such that water table levels are higher, soil conductivity is higher, or the area to be dewatered is larger than the assumptions in this analysis, dewatering rates could be higher and additional disposal may be necessary.

In addition, the infiltration rate of the Mid-Town disposal site should be measured from the start of construction including hourly readings (in terms of total gallons delivered) for the first three days and daily measurements thereafter to monitor any changes to the infiltration capacity of the site due to entrained sediment, piping in soil, etc. Once the Broderson disposal site comes online, infiltration monitoring should be started there as well. The specifications will require that the Contractor monitor and report the infiltration rate at each site during construction use. The infiltration rate is critical for the optimum performance of the disposal system at both sites.

It is recommended that the contract for the Area A and D bid package include the Mid-Town PS wet well construction and that the contract for the Area B and C bid package include the Broderson leachfield construction.

## Appendix

Central Coast Region Letter dated May 27, 2011, Use and Disposal Plan for Construction Dewatering, Los Osos Project



# California Regional Water Quality Control Board Central Coast Region



**Linda S. Adams**  
*Acting Secretary for  
Environmental Protection*

895 Aerovista Place, Suite 101, San Luis Obispo, California 93401-7906  
(805) 549-3147 • Fax (805) 543-0397  
<http://www.waterboards.ca.gov/centralcoast>

**Edmund G. Brown Jr.**  
*Governor*

May 27, 2011

Mr. John Waddell  
County of San Luis Obispo, Public Works Department  
County Government Center, Room 207  
San Luis Obispo, CA 93408

Dear Mr. Waddell:

## **USE AND DISPOSAL PLAN FOR CONSTRUCTION DEWATERING, LOS OSOS PROJECT**

The purpose of this letter is to clarify issues related to the use and disposal of water generated by dewatering during the construction of San Luis Obispo County's Los Osos Water Recycling Facility Project (Project). As discussed previously, construction dewatering is authorized under the statewide *General Permit for Storm Water Discharges Associated with Construction Activities (General Permit)*, provided such discharges comply with the permit conditions and best management practices (BMPs) to protect water quality. To enroll under the General Permit, create an account in the Stormwater Multiple Application and Report Tracking System (SMARTS) at:

<https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp>

Once registered in SMARTS, the legally responsible person or his or her authorized signatory or data submitter must electronically submit permit registration documents prior to commencing construction activities. The County must develop a construction dewatering plan to address all items described in this letter related to Project dewatering activities. The County must include this plan in the project Storm Water Pollution Prevention Plan (SWPPP). The County shall adhere to all other requirements related to Project construction activities pursuant to the General Permit. The following information is intended as guidance in developing and implementing BMPs in your SWPPP and construction bid documents.

Central Coast Water Board staff has determined that water generated by Project dewatering activities is an authorized non-stormwater discharge under the General Permit provided that the following conditions are satisfied:

1. The discharge does not cause or contribute to a violation of any water quality standard;

***California Environmental Protection Agency***

2. The discharge does not violate any other provision of the General Permit;
3. The discharge is not prohibited by the Central Coast Water Board Basin Plan;
4. The County has included and implemented specific BMPs required by the General Permit to prevent or reduce the contact of groundwater from dewatering with construction materials or equipment.
5. The discharge does not contain toxic constituents in toxic amounts or (other) significant quantities of pollutants;
6. The discharge is monitored and meets the applicable Numeric Action Limits and Numeric Effluent Limits (General Permit, V. Effluent Standards); and
7. The County reports the sampling information in an annual report.

Considering analytical results of samples collected by the Los Osos Community Services District (CSD) and Central Coast Water Board staff, we anticipate that bacteria, sediment, nitrate, and ammonia are constituents of concern to water quality. However, we have also taken into consideration that dewatering activities will be short-term and necessary for construction of the Project. Each of the constituents of concern is described below, followed by applicable water quality objectives, the basis for specified requirements, and actions needed to protect against, minimize, and mitigate for potential water quality impacts associated with construction dewatering activities. Compliance with the applicable water quality objectives (below) constitutes compliance with the aforementioned conditions for authorized non-stormwater discharge pursuant to Section III of the General Permit.

**Discharge Minimization** – Use and disposal of water generated by construction dewatering to land (i.e., compaction, dust control, irrigation, percolation, etc.) is the primary BMP to ensure water quality protection. The County must dispose of construction dewatering to land whenever feasible. The alternative disposal options described below are applicable only after the Central Coast Water Board agrees that land disposal options are infeasible. Feasibility considerations include, but are not limited to, project delay, environmental impacts, technical, and cost considerations.

**Bacteria** – Due to the proximity of septic systems to dewatering intakes, bacteria may be present in the discharge in excess of water quality objectives. A wide variety of coliform bacteria are naturally prevalent in soil, so, because of the source, fecal coliform bacteria are the most appropriate indicator of human pathogens. Accordingly, dewatering discharges must not cause receiving waters to exceed water quality objectives for fecal coliform bacteria of 14 most probable number per 100 milliliters

(MPN/100ml) median and no more than ten percent of samples exceeding 43 MPN/100ml. These objectives are based upon protection of the shellfish harvesting beneficial uses of the receiving waters<sup>1</sup>. Basin Plan criteria for protection of body-contact recreation beneficial uses of receiving waters are also applicable, but are less stringent than the shellfish objectives above. Body-contact recreation criteria for fecal coliform bacteria include 200 MPN/100ml log mean and no more than ten percent of samples exceeding 400 MPN/100ml. If disinfection of the discharge is implemented using chlorine, residual chlorine must be removed prior to discharge into surface waters.

Representative samples of construction dewatering discharges must be collected and analyzed for fecal coliform bacteria weekly while dewatering discharges continue.

**Sediment** – Our understanding of the proposed dewatering procedure is that shallow groundwater will be extracted from the soil rather than directly from the trench, although occasional pumping from trenches may be needed. Based upon this information, we do not anticipate excess sediment to be an issue of concern for water quality. However, discharges should be free of sediment concentrations that result in deposition or concentration of material that causes nuisance or adversely affects beneficial uses. Also, the discharge velocity should be diminished and conveyed to channels (rather than exposed mudflats) to minimize disturbance of bay sediments. This objective is based upon Basin Plan general objectives for all inland surface waters, enclosed bays and estuaries. Representative samples of construction dewatering discharges must be collected and analyzed for turbidity weekly while dewatering discharges continue. Compliance with the following effluent limitations<sup>2</sup> satisfies effluent standards in Section V.B. of the General Permit.

**Table 1 – Turbidity Effluent Limitations**

Parameter	Test Method	Discharge Type	Min. Detection Limit	Units	Numeric Action Level	Numeric Effluent Limitation
Turbidity	EPA 0180.1 and /or field test with calibrated portable instrument	Risk Level 2 <sup>1</sup>	1.0	NTU	250 NTU	N/A
		Risk Level 3 <sup>1</sup>			250 NTU	500 NTU

1 – Risk level will be determined by staff pursuant to Section VIII of the General Permit.

NTUs - Nephelometric Turbidity Units

N/A – not applicable

EPA –Environmental Protection Agency

<sup>1</sup> Morro Bay Pathogen TMDL, Resolution No. R3-2002-0117

<sup>2</sup> Table obtained from Section V.B., Table 1 of the Construction Stormwater General Permit Order No. 2009-0009-DWQ.

**pH** – According to October 2006 groundwater quality data for the Los Osos upper aquifer, pH ranges from 5.9 to 7.2<sup>3</sup>. In order to protect warm freshwater, cold freshwater, and ocean water habitats, pH shall not be depressed below 7.0 or raised above 8.5, and any change in normal ambient pH shall not exceed 0.5 in fresh waters<sup>4</sup>. pH can vary greatly in receiving waters (diurnal and annual fluctuations). Therefore, Section V.B. of the General Permit provides effluent limitations protective of surface water beneficial uses. Representative samples of construction dewatering discharges shall be collected and analyzed monthly for pH while dewatering occurs. Compliance with the following effluent limitations<sup>5</sup> satisfies Section V.B. of the General Permit..

**Table 2 – pH Effluent Limitations**

Parameter	Test Method	Discharge Type	Min. Detection Limit	Units	Numeric Action Level (NAL)	Numeric Effluent Limitation (NEL)
pH	Field test with calibrated portable instrument	Risk Level 2 <sup>1</sup>	0.2	s.u.	Lower NAL= 6.5 Upper NAL= 8.5	N/A
		Risk Level 3 <sup>1</sup>			Lower NAL= 6.5 Upper NAL= 8.5	Lower NEL= 6.0 Upper NEL= 9.0

s.u. – pH standard units

**Nitrate** – The Basin Plan does not have a water quality objective for nitrate specific to Morro Bay Estuary. However, as a biostimulatory substance, nitrate and other nitrogen-containing compounds may contribute to algal blooms resulting in water quality impairment. Algal blooms due to the discharge are prohibited. Therefore, dewatering discharges should be conveyed close to actively flowing channels in order to minimize accumulation of nutrients in shallow waters.

**Ammonia** – Due to septic system effluent discharges to shallow groundwater, water generated by construction dewatering may contain concentrations of ammonia that could be toxic to marine organisms. Construction dewatering discharges shall not cause receiving water concentrations of total ammonia to exceed 24 milligrams per liter as nitrogen (mg/L as N) in freshwater and 21 mg/L as N in Morro Bay. These criteria

<sup>3</sup> Table 3 - Los Osos Nitrate Monitoring Program, Los Osos Community Services District, Cleath and Associates, October 2006

<sup>4</sup> Pursuant to Section II.A.1 and Section II.A.2 of the Basin Plan

<sup>5</sup> Table obtained from Section V.B., Table 1 of the Construction Stormwater General Permit Order No. 2009-0009-DWQ.

are based upon USEPA ambient water quality criteria for waters with pH of 7<sup>6</sup>. If monitoring indicates a pH value above 7, then more stringent ammonia criteria may apply. In addition, according to Section II.A.2 of the Basin Plan, the discharge shall not cause concentrations of un-ionized ammonia (NH<sub>3</sub>) to exceed 0.025 mg/L in the receiving water (i.e., inland surface waters, enclosed bays, and estuaries). If the ammonia concentrations exceeds 24 mg/L (freshwater) or 21 mg/L (Morro Bay) and the pH value is above 7 when dewatering, then follow-up receiving water sampling for temperature and salinity is required. Representative samples of construction dewatering discharges shall be collected and analyzed monthly for ammonia and pH while dewatering occurs.

**Monitoring, Reporting, and Notifications** - The water quality objectives described above are for receiving waters. This means that compliance with the specified objective is measured in the receiving water rather than the discharge. However, due to the variability of receiving water quality and conditions, compliance monitoring must be implemented by representative sampling of the discharge. If discharge samples reveal concentrations in excess of water quality objectives, then follow-up sampling of receiving water must be implemented to verify compliance with the appropriate receiving water objectives. Throughout Project construction, monthly monitoring reports must be submitted summarizing bacteria, turbidity, pH, and ammonia monitoring data; estimated volume of dewatering discharges; time, date and location of dewatering and location of discharge. If monitoring results indicate noncompliance with criteria described above, then Central Coast Water Board staff must be notified immediately (via email or telephone). Additionally, monthly reports must include a description of corrective actions and a corresponding schedule for implementation.

### SUMMARY OF DISCHARGE & MONITORING REQUIREMENTS

Parameter	Water Quality Objective	Monitoring Frequency
Discharge Minimization	Alternatives Feasibility Evaluation	Advance Approval
Volume & Location	Recorded for each surface water discharge	Ongoing
Fecal Coliform Bacteria	14 MPN/100ml median	Weekly
	No more than 10% exceed 43 MPN/100ml	
Turbidity	250 NTU (NAL)	Weekly
	500 NTU (NEL)	
pH	6.5 to 8.5 (NAL) <sup>1</sup>	Monthly

<sup>6</sup> U.S. Environmental Protection Agency, Office of Water, National Recommended Water Quality Criteria 2002, EPA 822-R-02-047

	6.0 to 9.0 (NEL) <sup>1</sup>	
Ammonia	24 mg/l (as N) <sup>1</sup>	Monthly
Un-ionized Ammonia	0.025 mg/L (as N)	Calculated Monthly
Temperature	35 degrees C	Triggered if pH is above 7
Salinity	20 g/kg	Triggered if pH is above 7
Summary Reports	Discharge & Compliance Summary	Monthly

1 - If monitoring indicates a pH value above 7, then more stringent ammonia criteria may apply.

MPN/100ml – most probable number per 100 milliliters

NTUs - Nephelometric Turbidity Units

NAL – Numeric Action Level

NEL – Numeric Effluent Limitation

mg/L – milligrams per liter

g/kg – grams per kilogram

We look forward to completion of the Los Osos Water Recycling Facility Project as soon as possible to prevent further degradation of water quality due to septic system discharges and we are available to assist County staff if needed to facilitate project completion. If you have questions, please call **David LaCaro** at **(805) 549-3892** or by email [dlacaro@waterboards.ca.gov](mailto:dlacaro@waterboards.ca.gov).

Sincerely,



Roger W. Briggs  
Executive Officer

cc:

Paavo Ogren, SLO County Public Works Director ([pogren@co.slo.ca.us](mailto:pogren@co.slo.ca.us))

Mark Hutchinson, SLO County Environmental Manager ([mhutchinson@co.slo.ca.us](mailto:mhutchinson@co.slo.ca.us))

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# **Appendix E Habitat Management Plan**

## **Appendix E Habitat Management Plan**

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# **Habitat Management Plan for the Los Osos Wastewater Project, Los Osos, San Luis Obispo County, California**

Prepared for:

**County of San Luis Obispo**

Prepared by:

**SWCA Environmental Consultants**

November 2011

**HABITAT MANAGEMENT PLAN  
FOR THE  
LOS OSOS WASTEWATER PROJECT  
CDP A-3-SLO-09-055/069**

Prepared for:

**County of San Luis Obispo  
Department of Public Works**  
976 Osos Street, Room 207  
San Luis Obispo, CA 93408  
Contact: Kate Ballantyne

Prepared by:

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November 30, 2011

SWCA Project Number: 17175

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## 1. INTRODUCTION

This Habitat Management Plan (HMP) has been prepared for the Los Osos Wastewater Project (hereinafter “LOWWP”) in the community of Los Osos, San Luis Obispo County, California (refer to Figures 1 and 2). The HMP is designed to meet the mitigation requirements set forth by Coastal Development Permit (CDP) Application Number A-3-SLO-09-055/069, in response to the presence of environmentally sensitive habitat areas (ESHA) within the project impact zones. The CDP required preparation of an HMP defining restoration, enhancement, management, and protection of the 80-acre Broderson site, 12-acre Mid-Town site, roughly 8-acre habitat/buffer area at the Giacomazzi site, and approximately 0.55 acre at three pump station sites, for a combined HMP area of about 100 acres at the six sites (refer to Figure 2 and Table 1).

### 1.1 PROJECT DESCRIPTION

The LOWWP includes construction and operation of a community sewer system, including a treatment plant, collection/disposal/reuse facilities, and all associated development and infrastructure. The proposed treatment plant is sited on approximately 25 acres located at 2198 Los Osos Valley Road, known locally as the Giacomazzi site. Proposed collection, disposal, and reuse infrastructure would be located throughout the community of Los Osos, with the primary effluent disposal leach field proposed for 8 acres at the top of Sea Horse Lane, known locally as the Broderson site. The project would treat wastewater to a tertiary level, and would reuse as much of the treated effluent as possible for urban and agricultural irrigation, with disposal prioritized to reduce seawater intrusion and otherwise improve the health and sustainability of the underlying Los Osos groundwater basin.

Construction of the LOWWP will result in an unavoidable impact to 8.55 acres of Terrestrial Habitat (TH) ESHA. This HMP provides comprehensive revegetation and maintenance strategies for each of the six restoration sites, including a baseline assessment of current conditions, plan goals, planting plans and invasive species control methods, success criteria, and monitoring methodologies and schedules. Implementation, maintenance, and monitoring of the HMP will be conducted by the County of San Luis Obispo (County).

#### 1.1.1 Summary of Actions Proposed Under This HMP

This HMP addresses Special Condition 3 of the CDP and is designed to provide mitigation for impacts to approximately 8.55 acres of ESHA resulting from LOWWP implementation. These project impacts consist of permanent loss of coastal dune scrub/terrestrial habitat ESHA (8 acres at the Broderson leach field site and 0.38 acre at pump station locations). Special Condition 3 lists the following areas as subject to HMP implementation as mitigation for ESHA impacts.

*Special Condition 3. Habitat Management Plan.*

*PRIOR TO CONSTRUCTION, the Permittee shall submit two copies of a Habitat Management Plan to the Executive Director for review and approval. The Habitat Management Plan shall provide for restoration and enhancement of the following areas to self-sustaining natural habitat states, and for management and protection of such areas as habitat areas in perpetuity:*

- a. Broderson Site. The 80-acre Broderson site, of which up to 8 acres is allowed to be used for the project leach field provided this area too is subject to Plan requirements designed to ensure habitat value in this 8-acre area as much as possible while recognizing the underlying leach field infrastructure and its ongoing use and maintenance requirements.*

- b. *Giacomazzi Site. The 8.3 acres of the Giacomazzi site that is located outside of the approved development envelope and that includes identified wetland and related resources and their buffer (see Exhibit 8).*
- c. *Midtown Site. The 12.24-acre Midtown site (see Exhibit 2), of which a small area (approximately 0.10 acres, subject to special condition 1 requirements) is allowed to be used for the Midtown pump station and related development, provided this area, too, is subject to Plan requirements designed to ensure habitat value at the pump station location as much as possible while recognizing the underlying pump station infrastructure and its ongoing use and maintenance requirements.*
- d. *Pump Station Sites. The roughly 0.15-acre Sunny Oaks site, the 0.4-acre Solano site, and the 0.3-acre East Ysabel site (see Exhibit 2), a total of almost one acre, of which a small area at each site (approximately 0.32 total acres, subject to special condition 1 requirements) is allowed to be used for pump station and related development, provided these areas, too, are subject to Plan requirements designed to ensure habitat value at the pump station locations as much as possible while recognizing the underlying pump station infrastructure and its ongoing use and maintenance requirements.*

Per the requirements of CDP Application Number A-3-SLO-09-055/069, implementation of the HMP will restore and enhance the areas shown in Table 1 below.

**Table 1. LOWWP HMP Restoration and Enhancement Areas**

<b>Facility</b>	<b>Location</b>	<b>Size (acres)</b>	<b>Habitats Impacted</b>	<b>Restoration and Enhancement Area (acres)</b>
Treatment Plant / Mitigation Site	Giacomazzi	25.5	Agricultural lands	8.3
Pump Station	Sunny Oaks	0.15	Oak Woodland, Ornamental plantings	0.05
Pump Station / Mitigation Site	Mid-town Site	12.2	Disturbed Coastal Dune Scrub	12.1
Leach Field / Mitigation Site	Broderson Site	80	Coastal Dune Scrub, Non-native grassland, Eucalyptus/Cypress windrow	80
Pump Station	Solano Drive	0.4	Ornamental plantings	0.23
Pump Station	Santa Ysabel Avenue	0.3	Ornamental plantings, Non-native grassland	0.19
<b>Total Plan Revegetation Area (approximate)</b>				<b>100.87</b>

Figure 1. Project Vicinity Map



## **1.2 RESPONSIBLE PARTIES AND FINANCIAL ASSURANCES**

As the project applicant, the party responsible for implementing and maintaining the areas addressed in this HMP is:

County of San Luis Obispo  
Department of Public Works  
County Government Center, Room 207  
San Luis Obispo, CA 93408

The County Department of Public Works has the financial and technical means to implement this HMP and any required contingency actions. The need to establish a performance bond for the actions outlined in this HMP or any subsequent contingency measure is not anticipated at this time. Per the requirements of Special Condition 3, the County shall ensure that the Broderon site will be acquired prior to construction and granted by June 10, 2012, to an appropriate agency or conservation organization approved by the Executive Director of the Coastal Commission, and that use of the Broderon, Giacomazzi, Midtown, and Pump Station sites each shall be restricted through recordation of a deed restriction or easement, prohibiting all non-resource-dependent development on each site, other than that associated with the approved project and consistent with the approved HMP.

## **2. BASELINE CONDITIONS**

### **2.1 LOS OSOS AREA GENERAL CONDITIONS**

The community of Los Osos occupies gently rolling hills composed of sandy soils on stabilized dunes. The climate is Mediterranean, with rainfall occurring during the winter months. Summers are dry, often with coastal fog. Annual average precipitation in the Los Osos area is 17.61 inches, with highest average rainfall in February and lowest rainfall in July (Morro Bay Fire Department 1971-2000). The mean average temperature is 56 degrees Fahrenheit (°F). Soils consist primarily of Baywood fine sands, ranging from 2 to over 15 percent slopes. The sandy soils and marine climate combine to produce a unique coastal ecosystem that is home to a wide array of plant and animal species. The dune, bluff, dune scrub, and chaparral communities that comprise this unique coastal ecosystem are all considered ESHAs under California Coastal Commission requirements.

### **2.2 SITE-SPECIFIC BASELINE CONDITIONS**

Each of the six restoration sites addressed in the HMP have different baseline conditions, infrastructure requirements, and revegetation potential, and each site has specific issues that will affect plant species selection and implementation methods. Current baseline conditions for each of the six sites, described below, are based on evaluations performed by SWCA Environmental Consultants (SWCA) biologists, Bob Sloan and Travis Belt, in December 2010, April 2011, and October 2011. Site locations are shown on Figure 2, and habitat maps are included as Figures 3 through 8.

#### **2.2.1 Giacomazzi**

The Giacomazzi site consists of rolling cultivated agricultural upland areas, eroding uncultivated areas, annual grasslands, and a coastal wetland and tributary channel to the adjacent but off-site Warden Lake. Figure 3 displays the existing conditions on the site. Soils on the site are mapped as Concepcion loam, 2 to 5 and 5 to 9 percent slopes. Concepcion loam soils feature very slow permeability, moderate to high water capacity, and moderate erosion potential.

Figure 2. Project Location Map



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The cultivated portions of the site slope downward toward the northeast into a depression wetland dominated by arroyo willow (*Salix lasiolepis*) and surrounded by coyote bush (*Baccharis pilularis*). This wetland area also contains several coast live oak trees (*Quercus agrifolia*), along with a variety of understory species, including saltgrass (*Distichlis spicata*), curly dock (*Rumex crispus*), prickly ox-tongue (*Picris echioides*), bermuda grass (*Cynodon dactylon*), Western ragweed (*Ambrosia psilostachya*), and English plantain (*Plantago lanceolata*). The wetland contains saturated soils and small, shallow ponded areas, but does not provide suitable habitat for aquatic or semi-aquatic wildlife species. Uncultivated annual grassland areas are present on both the east and west sides of the wetland area; the western grassland area is highly eroded.

Two eroded drainage channels traverse the cultivated areas and drain into the wetland area. While these drainages may once have been natural features, years of farming and disking have reduced them to erosional scars that rapidly convey runoff to the wetland area at the northeastern corner of the site. The upper portions of the drainage ditches are dominated by non-wetland invasive weeds and non-native annual grasses including wild radish (*Raphanus sativus*), corn spurry (*Spergula arvensis*), scarlet pimpernel (*Anagallis arvensis*), Italian rye-grass (*Lolium multiflorum*), wild oats (*Avena fatua*), ripgut brome (*Bromus diandrus*), and soft chess brome (*Bromus hordeaceus*). The upper, erosional portions of the two drainages were determined to be non-jurisdictional by the U.S. Army Corps of Engineers (USACE) and by the California Coastal Commission. The lower portions of the drainages contain riparian vegetation, and are considered jurisdictional by the above agencies, Regional Water Quality Control Board (RWQCB), and California Department of Fish and Game (CDFG).

### 2.2.2 Sunny Oaks

The Sunny Oaks site is located at the corner of Los Osos Valley Road and the entrance to the Sunny Oaks Mobile Home Park. Figure 4 displays the existing conditions on the site. Soils on the site are mapped as Baywood fine sand, 2 to 9 percent slopes. Baywood fine sand soils feature rapid permeability, low water capacity, and medium erosion potential. The site slopes to the north, away from Los Osos Valley Road, and contains a large Sunny Oaks Mobile Home Park sign. The site is bordered by several large coast live oak trees along the south and west sides, and a small, densely vegetated drainage channel is present south of the site. The northern and eastern edges of the site are dominated by fig-marigold (*Carpobrotus edulis*), and several ornamental shrubs (*Buddleja* sp.) are present in the middle portion. Remaining areas are regularly mowed and contain common annual weedy species, including Bermuda buttercup (*Oxalis pes-caprae*), and various annual grasses. The oak canopy provides dense shade over the south and western edges, and the adjacent riparian area contains a combination of native understory plants including coffeeberry (*Rhamnus californica*) and bracken fern (*Pteridium aquilinum*), mixed with an infestation of Cape ivy (*Delairea odorata*). Construction of the pump station will require pruning several oak trees and removal of the *Buddleja* and *Carpobrotus*. No impacts to the drainage channel are proposed.

### 2.2.3 Mid-town

The Mid-town site is located at the corner of Los Osos Valley Road and Palisades Avenue, and occupies approximately 12 acres. Figure 5 displays the existing conditions on the site. Soils on the site are mapped as Baywood fine sand, 2 to 9 percent slopes. Baywood fine sand soils feature rapid permeability, low water capacity, and medium erosion potential. This site is known to contain the federally protected Morro shoulderband snail (*Helminthoglypta walkeriana*).

Much of the site was graded and disturbed in 2005 by a previous project and is currently vacant. A large erosional channel meanders through the site from Los Osos Valley Road to the southwest, ending in a large shallow depression area. Previously graded portions of the site (including a large area of fill soil stockpiled near the South Bay library) have developed a sparse cover of volunteer native coastal scrub

species, intermixed with veldt grass (*Ehrharta calycina*), other non-native species, and bare ground. Areas of the site that were not graded in 2005 contain relatively intact coastal dune scrub habitat.

Dominant species observed at the Mid-town site include coyote brush, mock heather (*Ericameria ericoides*), deerweed (*Lotus scoparius*), California sage, (*Artemisia californica*), coastal goldenbush (*Isocoma menziesii*), and herbaceous species such as California croton (*Croton californicus*), wild oat (*Avena* spp.), soft chess brome (*Bromus hordeaceus*), riggut brome (*Bromus diandrus*), annual ryegrass (*Lolium multiflorum*), cheeseweed (*Malva parviflora*), sow thistle (*Sonchus oleraceus*), filaree (*Erodium cicutarium*), wild radish (*Raphanus sativus*), fennel (*Foeniculum vulgare*), summer mustard (*Hirschfeldia incana*), black mustard (*Brassica nigra*), and fig-marigold. Several volunteer arroyo willows are present in the depressional area.

#### 2.2.4 Broderson

The Broderson site is located above Highland Drive, between Broderson and Doris Avenues. Figure 6 displays the existing conditions on the site. Soils are mapped as Baywood fine sand, 2 to 9 and 9 to 15 percent slopes. Baywood fine sand soils feature rapid permeability, low water capacity, and medium erosion potential. This site is known to contain the federally protected Morro shoulderband snail.

The Broderson site consists of an 80-acre, southerly sloping rectangle overlooking Los Osos. The site contains disturbed coastal scrub and non-native grasses in its lower portion and a dense cover of maritime chaparral in higher elevation areas. The site contains numerous trails and is used for recreational purposes, including hiking and horseback riding. The maritime chaparral habitat on the Broderson property supports the federally threatened Morro manzanita (*Arctostaphylos morroensis*), along with an array of common species, including buckbrush (*Ceanothus cuneatus*), Blochman's leafy daisy (*Erigeron foliosus* var. *blochmaniae*), San Luis Obispo wallflower (*Erysium suffrutescens* var. *lompocense*), sand almond (*Prunus fasciculata* var. *punctata*), coast live oak, monkeyflower, coast buckwheat, coyote brush, mock heather, and California sage.

The coastal scrub habitat present in the lower portion of the site and proposed leach field area has been heavily invaded by veldt grass and exhibits limited species diversity. This area includes several large stands of blue gum eucalyptus (*Eucalyptus globulus*) and scattered coast live oak trees and Monterey cypress (*Cupressus macrocarpus*). The large eucalyptus and cypress trees provide potential nesting habitat for a variety of bird and raptor species, but the eucalyptus leaf litter is also detrimental to establishment and survival of coastal scrub habitat.

#### 2.2.5 Solano

The Solano Pump Station site is located at the corner of Solano Street and Butte Drive, immediately adjacent to the Sea Pines Golf Course. Figure 7 displays the existing habitat conditions on the site. Soils are mapped as Baywood fine sand, 2 to 9 percent slopes. Baywood fine sand soils feature rapid permeability, low water capacity, and medium erosion potential. The pump station site is located within a chain link fence and consists of flat, disturbed areas adjacent to golf course cart paths and equipment sheds. The site is bordered to the north by non-native annual grassland and coastal scrub, and the Pecho Marsh wetland area, which contains a dense canopy of arroyo willow trees with an understory of field sedge (*Carex praegracilis*).

The area proposed for disturbance does not contain any natural habitat and is dominated by annual grasses and weeds. Adjacent ornamental street plantings along Solano Drive consist of the southern California native plant lemonadeberry (*Rhus integrifolia*), with several occurrences of the highly invasive giant reed (*Arundo donax*) also present in the planting strip.

### 2.2.6 East Ysabel

The East Ysabel site is located at the southwest corner of Santa Ysabel Avenue and South Bay Boulevard. Figure 8 displays the existing conditions on the site. Soils on the site are mapped as Baywood fine sand, 2 to 9 percent slopes. Baywood fine sand soils feature rapid permeability, low water capacity, and medium erosion potential. The site is bordered to the west by residences and to the south by a fenced stormwater detention basin.

The site consists of a depressional area with steep road banks on the northern and eastern sides. Several storm drains and street gutter drains empty into the site, and a faint swale is present in the middle portion. The site appears to have been disturbed by construction and maintenance of the adjacent stormwater detention basin. Vegetation consists primarily of annual grassland and fig-marigold, and a variety of ornamental trees along the western portion of the site. Several clumps of coyote brush present constitute the only native habitat features on the site.

## 3. GOALS OF THE HABITAT MANAGEMENT PLAN

The primary goal of this HMP is to mitigate for impacts to sensitive habitats by restoring and enhancing native habitat areas, resulting in creation of self-sustaining and diverse native plant communities requiring minimal maintenance inputs. Implementation will replace native habitats removed by project activities, create or enhance native plant communities in suitable project areas, and cause a net gain in native habitat area and quality. This goal will be accomplished through removal of non-native plant species, planting native vegetation suited to the specific conditions of the six sites, and maintaining those sites in perpetuity.

Implementation of the LOWWP HMP will:

- restore, enhance, and protect natural habitat areas;
- increase the abundance and diversity of native plant species and promote the movement of wildlife;
- create and enhance habitat for sensitive species;
- remove non-native and invasive plant species;
- provide screening for project facilities;
- provide recreational and educational benefits for the community; and,
- ensure ongoing stewardship and maintenance of the restored/enhanced sites.

Figure 3. Giacomazzi Habitat Map

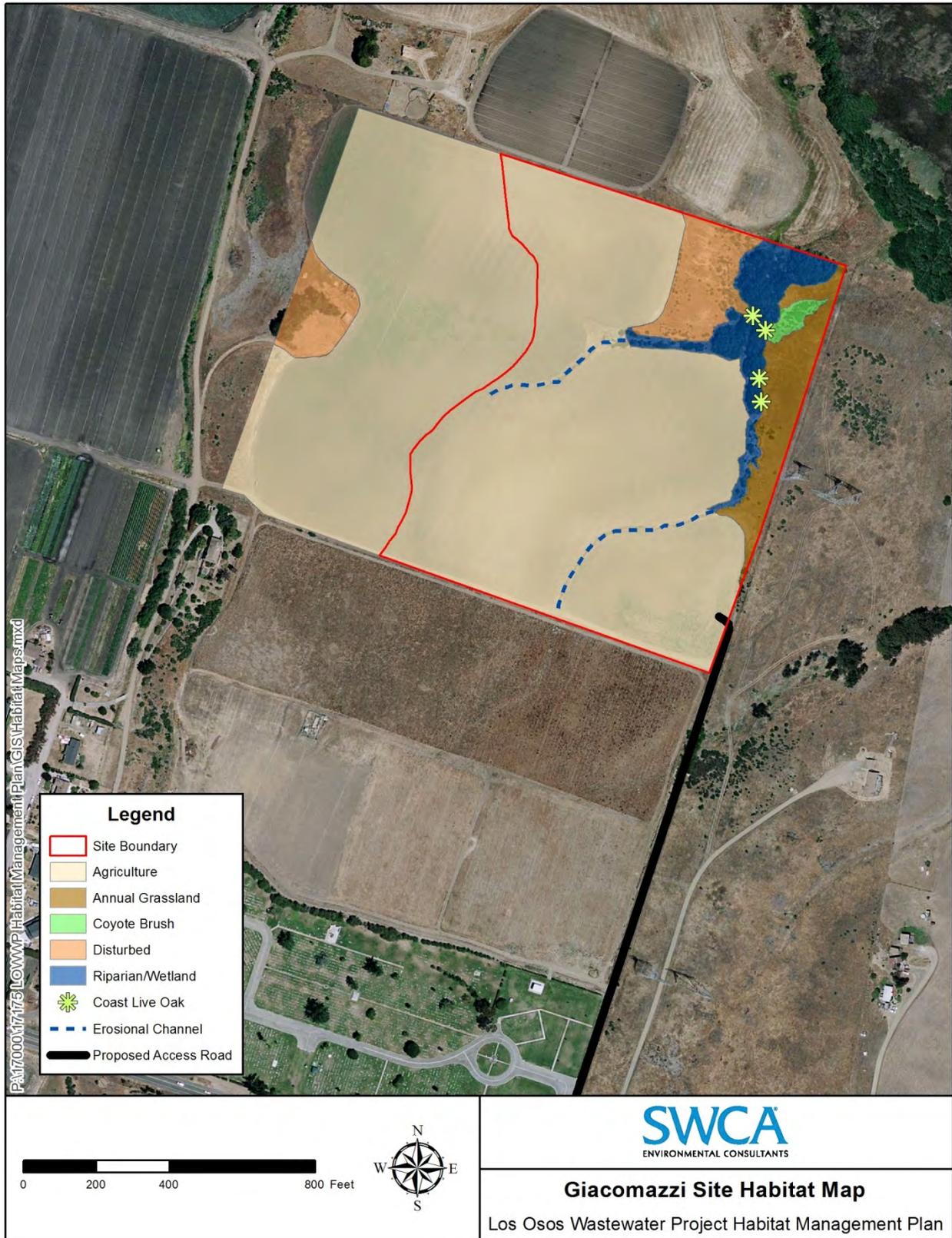


Figure 4. Sunny Oaks Habitat Map



Figure 5. Mid-town Habitat Map

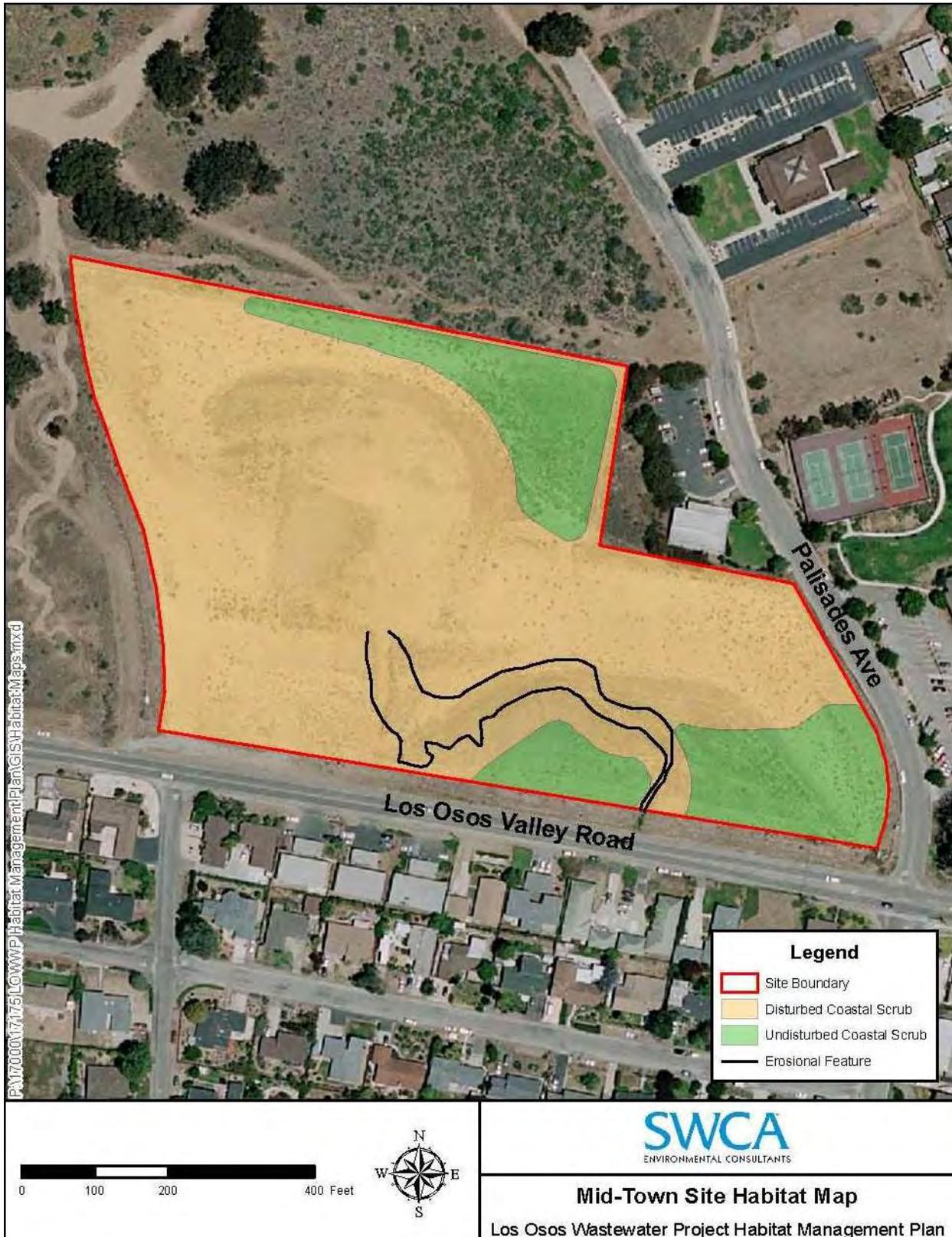


Figure 6. Broderson Habitat Map

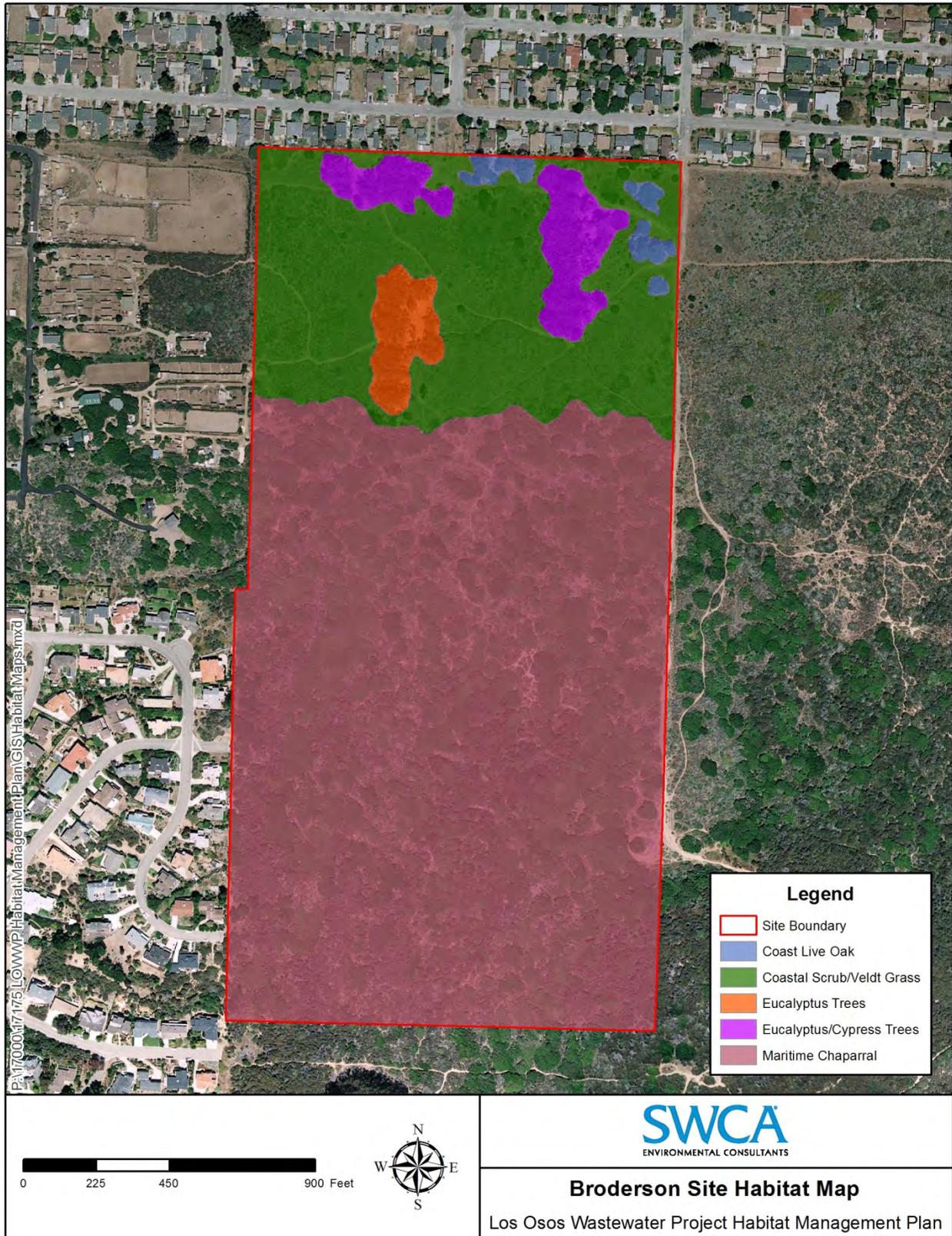


Figure 7. Solano Habitat Map

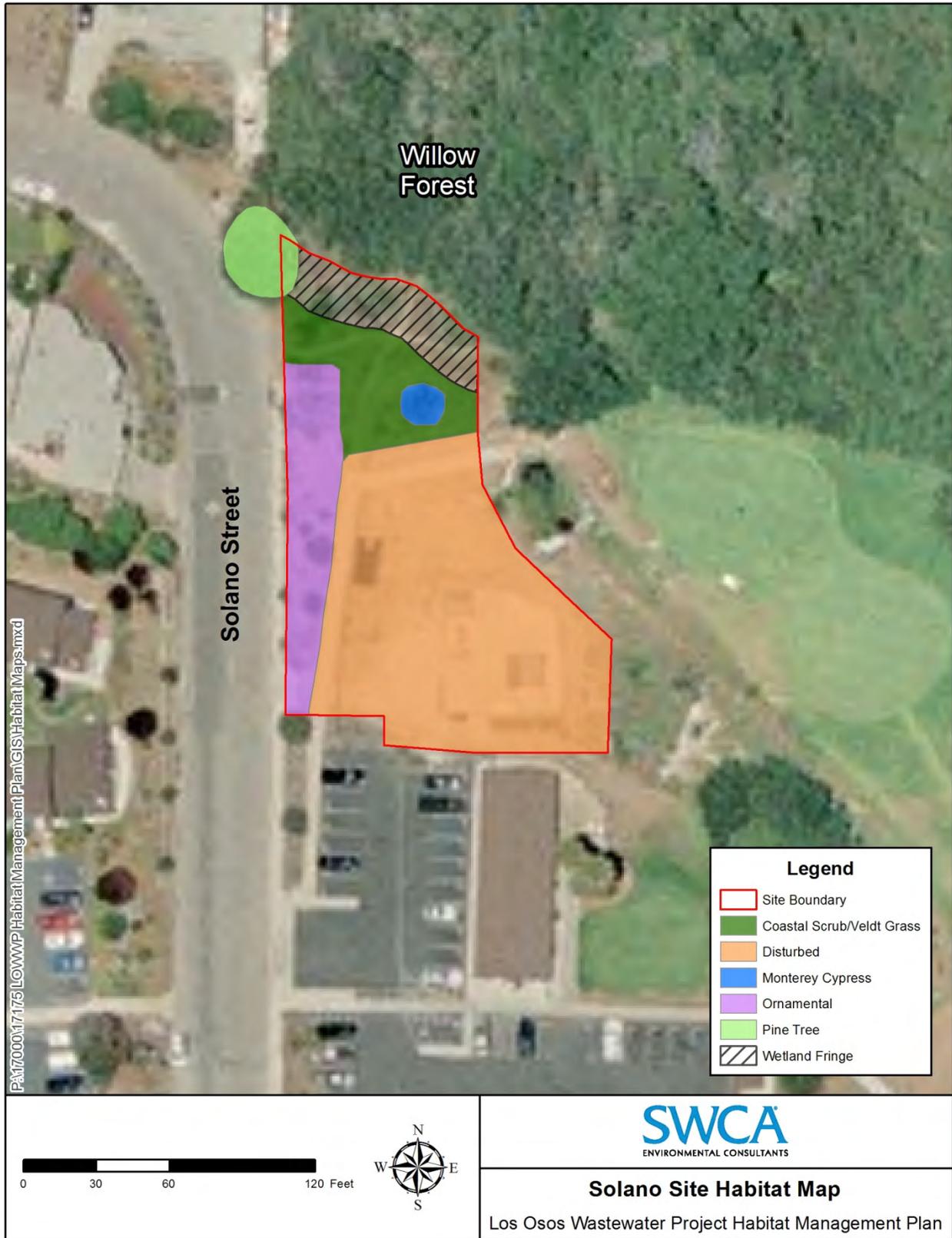


Figure 8. East Ysabel Habitat Map



## 4. PLANTING MATERIALS AND METHODS

Implementation of the restoration and enhancement activities will be overseen by a County-approved biologist or restoration specialist (Project Biologist). The Project Biologist will utilize this HMP, the attached site-specific Landscape Plan sheets and Specifications (refer to Appendix A), and County-prepared grading plans to direct implementation at each of the six sites. The Project Biologist will oversee site preparation, exotic species removal, irrigation system installation, plant installation, and maintenance activities, and will ensure conformity with this HMP. Seed mix composition and amounts, plant numbers, and plant spacing will follow the landscape plan sheet specifications, unless the Project Biologist determines a need for minor changes based on final site contours, seed or plant availability, or other factors. Restoration planting and irrigation installation shall be performed in accordance with the landscape plan sheets and the methods described in this section.

### 4.1 GENERAL SITE PREPARATION

The restoration planting sites shall be prepared and protected using the methods described below, as described in the Specifications provided in Appendix A and in the Stormwater Pollution Prevention Plan (SWPPP) prepared for the project.

#### 4.1.1.1 Surface Preparation

Surface preparation is necessary on graded or disturbed areas to provide a rough and uneven soil surface that will provide a rough seedbed for establishing vegetative cover. These preparatory actions should be completed immediately prior to seeding and planting efforts. Surface preparation details are described below.

- All final grade areas should have soil surfaces lightly roughened and loosened to a depth of 1-2 inches (tilling or raking), or by leaving slopes in a roughened condition after grading with tracked equipment prior to planting.

#### 4.1.1.2 Noxious Weed Species

Restoration sites containing noxious weed species shall undergo a grow-and-kill cycle following grading, or disturbance will be implemented where needed to remove weed seed banks in the soil prior to planting. The primary noxious weed that will require chemical treatment during grow-and-kill efforts is *Ehrharta calycina*. Removal of this species will rely on the use of grass specific herbicides, such as Arrow 2EC, Fusilade (Fluazifop-p) or similar, to protect native broad-leaved species. A list of expected weed species and best management practices is included in Appendix D. Grow-and-kill cycle details are described below.

- Following final grading, areas to be planted that are known to contain significant weed seed content (including Broderon, Giacomazzi, and East Ysabel) shall be watered repeatedly to stimulate germination of existing weed seeds. Sprouted weeds should be disked, sprayed with herbicide, or removed by hand to conclude at least one grow-and-kill cycle prior to planting or seeding activities.
- All herbicide applications will be performed by an individual in possession of a Qualified Applicators License and with experience managing exotic species. Although the Qualified Applicator will determine the appropriate timing for the herbicide applications, it is estimated that at least two applications per year will be necessary to effectively reduce the exotic grass population and soil seed bank prior to planting efforts.

#### **4.1.1.3 Erosion Control**

An effective combination of erosion and sedimentation control measures shall be installed by the Contractor prior to start of grading at each site, and maintenance of those measures should be conducted on a daily basis during construction to prevent sedimentation of on-site and adjacent habitats. Suitable erosion and sedimentation control measures should be maintained on-site until plant cover is sufficiently dense to protect the soil from erosion. Measures should include use of straw wattles, silt fence, jute netting, mulch, sand or gravel bags, inlet protection, and temporary detention basins as needed to control sedimentation and erosion on the site, as specified in Appendix A, Sheet 9, and the project SWPPP. All materials used shall be biodegradable; measures incorporating plastic mesh will not be allowed.

#### **4.1.1.4 Irrigation Systems**

Irrigation shall be used to ensure container plant survival during installation and establishment of restoration plantings. Irrigation for container plants shall be applied by installation of drip irrigation systems, as specified in Appendix A, prior to or immediately following plant installation. Oak acorn plantings will be watered by hand or by drip irrigation as convenient. Because these native plants must eventually survive in the absence of supplemental irrigation, deep roots are needed to tap into perennial soil moisture. Watering methods and schedules should approximate typical rainfall patterns, with sufficient watering duration to provide wetting of the entire root zone. Water shall be supplied as needed during winter months to supplement rainfall amounts received. Summer watering during establishment shall be at infrequent intervals, but shall address plant needs resulting from sandy soil conditions.

### **4.2 PLANTING MATERIALS AND PRACTICES**

Planting efforts under this HMP will consist of installing container plants in specific areas and several methods of seeding. Container plant installation is best performed in winter months when soil moisture is present within the rooting zone, but can occur at any time of year following installation of an irrigation system that will adequately water planted materials. Planting and seeding shall occur as described in the following sections and in the Landscape Plans and Specifications provided in Appendix A.

#### **4.2.1 Container Stock Condition and Methods**

Container stock quality and size shall conform to the State of California Grading Code of Nursery Stock, No. 1 grade. Only contract grown stock shall be used. Plants shall be the species and sizes shown on the plan. No ornamental varieties or cultivars shall be used. No species substitutions will be used without the written approval of the Project Biologist. Container stock shall be: symmetrical; typical for species; sound; healthy; vigorous; free from insect pests or eggs; shall have healthy, normal root systems; and well filling their containers but not to the point of being root bound. Plants shall not be pruned prior to installation. Container plants are listed in the text for each planting area, and a complete list is included in Appendix B.

The Contractor shall excavate planting holes at least 24 inches in diameter. Only native soil backfill shall be used. Do not fertilize. Crowns must be set slightly above the surrounding grade. Space plants as directed by the plans or by the Project Biologist. Completely fill the plant basin with water before mulching and allow percolating. Fill again with water, percolate, and apply weed barrier fabric, pre-emergent herbicide, or mulch over the disturbed soil area. Irrigate again in two weeks, or as needed, due to sandy soils. Following plant establishment, provide deep watering at wide intervals to encourage deep rooting, e.g., 30 to 60 days. Do not overwater.

## 4.2.2 Seed Collection

Seed collected for use in HMP areas shall be obtained from local natural habitats to preserve the genetic makeup of existing plant populations. The “local” seed collection area for this project consists of all areas within 20 miles of the coast, between Point Conception to the south and Piedras Blancas to the north. To preserve the viability of native plant communities used for collection, no more than 10 percent of available seed per plant will be harvested. Collection activities in areas proposed for disturbance (i.e., Broderson leach field, Mid-town) will harvest all available seed. Collection in areas known to contain the Morro shoulderband snail will be conducted under dry conditions and will avoid trampling vegetation that could contain individuals of the species.

## 4.2.3 Seeding Methods

Seeding with native species will occur over large areas of the HMP and will require use of several methods due to soil types, site conditions, and specific project needs. Seeding methods to be used during implementation of this HMP are discussed below and in the Landscape Plans and Specifications provided in Appendix A. Seed mixes are listed in the text for each planting area, and a complete list is included in Appendix B.

### 4.2.3.1 Seed Drill

Seed drilling will be used at the Giacomazzi site to install native grass and shrub seed over the agriculturally disturbed portion of the restoration area. Seed drilling shall occur prior to planting of oak acorns on site. Supplemental irrigation will not be supplied to seeded areas. Drill seed will be applied to the designated area as follows:

1. Drill seed in rows at a maximum distance of 8 inches apart.
2. Drill seed depth setting will be 1 inch.
3. A minimum of three passes in different directions with seeding equipment will be performed to distribute the seed and reduce uniform row appearance.

### 4.2.3.2 Oak Acorn Planting

Coast live oak acorns will be planted at Giacomazzi in seed drill areas, riparian repair areas, and along the eastern property line. A total of seven approximately 500-square foot oak planting areas will be planted, as specified in Appendix A, Landscape Sheet 1. Each area will contain five separate acorn planting locations, spaced approximately 100 feet apart.

Acorns will be collected from coast live oak trees growing in the Los Osos area. Suitable collection areas include the Sunny Oaks pump station, Broderson site, and Los Osos Oaks State Reserve. Collection shall occur in the fall, and acorns should be taken from trees rather than the ground where possible. The collected acorns shall be processed immediately after collection. Processing will include cleaning, removing the caps, and checking for viability. The viability check requires dropping the acorns into a bucket of water; acorns that float are probably damaged and acorns that sink are most likely viable.

Immediately following processing, a minimum of 250 collected acorns will be placed in a sealed plastic bag and cold stratified for at least one month in a refrigerator. The refrigerator should be kept between 35 and 41°F. Immediately prior to planting, another viability check shall be conducted, and any acorns that float shall be discarded.

The acorn planting effort will occur immediately following completion of seed drilling. Place a wire mesh in-soil basket and surface enclosure in each planting location, per Detail 42, Sheet 8 (refer to Appendix A), with diameter and depth of basket to be 24 inches. Soil at each oak planting location shall

be loosened to a depth of 4 inches over a 24-inch diameter circle, and three to five acorns shall be placed on their sides at a depth of 2-3 inches and covered with soil. A 1-inch cover of mulch shall be placed over each planting location, and each area shall be watered thoroughly.

Supplemental water will be supplied on an as needed basis via a drip irrigation system or by hand watering for three years following planting. All supplemental watering will be performed in a manner that ensures deep penetration of water to the soil around established oak trees.

#### 4.2.3.3 Hydroseeding

Hydroseed application will be used to stabilize drainage layback areas, and steep slopes under jute netting (refer to Landscape Plans and Specifications in Appendix A). Hydroseed applications must adhere to the following specifications.

- The Project Biologist must be present to inspect the seed tags and amounts of materials being mixed and applied, and shall reject any materials or work not conforming to the specifications. Mixing time of materials shall not exceed 45 minutes from the time the seed contacts the water until the entire batch is discharged onto the earth.
- Repair Slopes: Prepare Batch 1 of slurry using wood fiber mulch at 1,000 pounds per acre with seed and water in proportions specified on the plans or herein. Apply this mix to areas designated on plans. Prepare Batch 2 of slurry using wood fiber mulch at 1,000 pounds per acre and tackifier at 80 pounds per acre with no seed and water in proportions specified on the plans or herein. Apply this mix over Batch 1 mix.
- Under Jute Mesh: Prepare slurry using wood fiber mulch at 2,000 pounds per acre and tackifier at 80 pounds per acre with seed and water in proportions specified on the plans or herein.
- All other areas identified on plans: Prepare slurry using wood fiber mulch at 2,000 pounds per acre with seed and water in proportions specified on the plans or herein.

#### 4.2.3.4 Broadcast Seeding

Broadcast seeding methods will be used to spread coastal scrub seed mix at the Broderon, Mid-town, and East Ysabel sites. Broadcast seed application will occur in all graded or disturbed areas, areas where exotic species have been removed, and around container plant installation areas. Following application, the seed should be lightly raked into the soil surface or otherwise covered to minimize losses by predation.

### 4.3 DO NOT PLANT LIST

No plant species listed as problematic and/or invasive by the California Native Plant Society, the California Exotic Pest Plant Council, or by the State of California shall be employed or allowed to naturalize or persist on the sites. No plant species listed as a 'noxious weed' by the State of California or the U.S. Federal Government shall be utilized or maintained within the restoration sites. The following list contains invasive ornamental species that have potential to escape into and disrupt native habitats in the Los Osos area. These species should not be utilized in landscaped areas of the project, and should not be a component of any seed mix utilized for the project.

<i>Carpobrotus edulis</i>	Fig-marigold
<i>Cortaderia selloana</i>	Pampas grass or jubata grass
<i>Cotoneaster mycrophyllus</i>	Cotoneaster
<i>Cotula coronopifolia</i>	Brass buttons

<i>Cytisus scoparius</i>	Scotch broom
<i>Cytisus striatus</i>	Portuguese broom
<i>Eichhornia crassipes</i>	Water hyacinth
<i>Genista monspessulana</i>	French broom
<i>Hedera canariensis</i>	Algerian ivy
<i>Hedera helix</i>	English ivy
<i>Iris pseudacorus</i>	Yellow water iris
<i>Myoporum laetum</i>	Myoporum
<i>Nassella tenuissima</i>	Mexican feather grass
<i>Olea europaea</i>	Olive
<i>Pennisetum setaceum</i>	Green fountain grass
<i>Robinia pseudoacacia</i>	Black locust
<i>Rubus discolor</i>	Himalayan blackberry
<i>Schinus molle</i>	Peruvian pepper tree
<i>Schinus terebinthifolius</i>	Brazilian pepper
<i>Senecio mikanioides</i> (= <i>Delairea odorata</i> )	Cape ivy, German ivy
<i>Spartium junceum</i>	Spanish broom
<i>Vinca major</i>	Periwinkle

## 5. SITE-SPECIFIC RESTORATION PLANS

The LOWWP HMP contains separate plans, methods, and materials for each of the six restoration sites. Detailed specifications and landscape plans for each site are included in Appendix A. Habitat restoration and enhancement will occur in the designated planting areas as shown on the site-specific plan sheets.

Plant materials used in the restoration areas will be obtained through seed collection and propagation of local materials. Seed collection efforts may be augmented by native seed mixes purchased from local providers if necessary to meet project goals. Once established, planted natives will be expected to compete successfully against non-native species with minimal maintenance input.

Mitigation will be achieved through removal of non-native plant species, planting of native vegetation suited to specific site conditions, maintenance of hydrologic functions, installation of fencing and educational signage to limit disturbance where appropriate, and scheduled maintenance practices. The restoration area boundaries will be fenced where appropriate, and may include exhibit sensitive habitat signs placed in suitable locations. Sign text shall notify the public that the fenced areas contain sensitive habitats, and that activities or entrance into the fenced area is prohibited except on existing pathways.

The six restoration area locations are shown in Figure 2, and are discussed in detail below. Landscape plans and schematics are included in Appendix A.

### 5.1 GIACOMAZZI

Restoration of the Giacomazzi site will consist of planting native grasses, shrubs, and coast live oak acorns on upland areas; layback, stabilization, and planting of eroded drainage channels; and removal of non-native plants from riparian and wetland areas. Due to the presence of wild pigs in the area, temporary fencing may be required to protect restoration plantings.

### 5.1.1 Upland Areas

Upland areas at Giacomazzi consist of agriculturally disturbed areas, a severely eroded east-facing slope, and a narrow northerly sloping area along the eastern property line. Upland areas will be seeded using a seed drill. The intent will be to create a mixed grassland/coastal scrub/oak savanna community of vigorous colonizer species on the disturbed site, and provide the basis for future successional community development. Following seeding with the mix below, a total of seven approximately 500-square foot oak planting zones containing five separate acorn planting locations will be established to add habitat diversity to the site. Seeding will occur over an approximately 5.75-acre area. The upland seed mix (Seed Mix 1) for this area contains the following native grass and forbs. Seed specifications are listed in Appendix A on Sheet 1.

#### Seed Mix 1 (Coastal Scrub/Grasses)

<i>Artemisia californica</i>	California sage
<i>Baccharis pilularis</i>	Coyote brush
<i>Bromus carinatus</i>	California brome
<i>Leymus condensatus</i>	Giant rye
<i>Lotus scoparius</i>	Deerweed
<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Nassella pulchra</i>	Purple needlegrass
<i>Salvia mellifera</i>	Black sage

### 5.1.2 Drainage Channel Repair and Setback Areas

Portions of the two drainage channels above the willow wetland area contain steep, severely eroded banks, trash dumps, and non-native plants. Implementation of this portion of the HMP will stabilize disturbed bank areas, restore native vegetation in disturbed bank areas, and remove exotic species from channel and setback areas. Work in the two channels may also require construction of minor grade control structures to reduce potential for headcutting erosion to occur.

Steep, eroded banks will be scraped back to a stable configuration, jute netting will be installed to assist bank stabilization, and all repaired areas will be hydroseeded with Seed Mix 2. Remnant areas of coastal scrub present in this area will be avoided where possible during the repair effort. Container plants will be planted along the repaired banks, and a temporary drip irrigation system will be installed to provide water during establishment. The total repair area covers approximately 2 acres. The container and seed mix plant palette for the drainage repair areas consists of the native grass and forb species listed below. Plant counts, location, spacing details, and seed specifications are listed in Appendix A on Sheet 1, and bank layback and grade control structure details are presented on Sheet 9.

#### Container Plant List

<i>Artemisia californica</i>	California sage
<i>Artemisia douglasiana</i>	Mugwort
<i>Baccharis pilularis</i>	Coyote brush
<i>Rubus ursinus</i>	California blackberry
<i>Salvia mellifera</i>	Black sage

**Seed Mix 2 (Coastal Scrub/Drainage)**

<i>Artemisia californica</i>	California sage
<i>Artemisia douglasiana</i>	Mugwort
<i>Baccharis pilularis</i>	Coyote brush
<i>Distichlis spicata</i>	Saltgrass
<i>Leymus condensatus</i>	Giant rye
<i>Leymus triticoides</i>	Beardless wildrye
<i>Lotus scoparius</i>	Deerweed
<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Salvia mellifera</i>	Black sage

**5.2 SUNNY OAKS**

Restoration plantings on the Sunny Oaks site will consist of removal of non-native species, and installing screen plantings to limit visibility of the Pump Station from Los Osos Valley Road. Planting will occur on road banks and open areas in the middle of the site and immediately adjacent to pump station structures. All planting will consist of container plants, watered by drip irrigation. No seeding will occur, and bare ground areas around plantings will be covered with mulch. The screen plantings will consist of the species listed below. Plant counts, location, spacing, and irrigation details are provided on Sheets 4 and 5 in Appendix A.

**Container Plant List**

<i>Baccharis pilularis</i>	Coyote brush
<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Myrica californica</i>	Pacific wax-leaf myrtle
<i>Prunus ilicifolia</i>	Hollyleaf cherry
<i>Rhamnus californica</i>	Coffeeberry
<i>Rosa californica</i>	California rose

**5.3 MID-TOWN**

Restoration of the Mid-town site will consist of removing non-native plant species, planting and seeding restored areas with native coastal scrub species, and stabilizing the proposed swale. This site is known to contain the federally protected Morro shoulderband snail, and all restoration work must meet the requirements of the U.S. Fish and Wildlife Service (USFWS) Biological Opinion for the project. Restoration efforts at the Mid-town site will occur in several phases as project construction and staging area uses allow.

**5.3.1 Coastal Scrub Restoration**

Coastal scrub habitat present on the site ranges from highly degraded to relatively pristine. Following removal of stockpiled soil, repair of the large erosional feature, and grading for basin and swale construction, large portions of the site are expected to have little vegetative cover remaining. Restoration will focus on removal of remaining non-native species and seeding disturbed areas (including around the Pump Station) with a native seed mix. The post-construction site to be restored will consist of undisturbed areas with existing good condition coastal scrub, disturbed upland areas, and an approximately 2-acre percolation basin that will receive stormwater runoff from the surrounding developed areas. This basin is not expected to pond water, but will be seasonally wetter than surrounding higher elevation areas. Therefore, two seed mixes have been designed to meet the two hydrologic

regimes expected on the site. The two seed mixes for Mid-town coastal scrub areas consists of the native grass and forb species listed below. Required seed amounts are listed on Sheet 3 in Appendix A.

**Seed Mix 4 (Upland Areas)**

<i>Achillea millefolium</i>	Yarrow
<i>Artemisia californica</i>	California sage
<i>Baccharis pilularis</i>	Coyote brush
<i>Ericameria ericoides</i>	Mock heather
<i>Eriogonum parvifolium</i>	Sea-cliff buckwheat
<i>Eriophyllum staechadifolium</i>	Coastal golden yarrow
<i>Lotus scoparius</i>	Deerweed
<i>Lupinus chamissonis</i>	Dune bush lupine
<i>Salvia mellifera</i>	Black sage

**Seed Mix 5 (Percolation Basin)**

<i>Artemisia douglasiana</i>	Mugwort
<i>Baccharis pilularis</i>	Coyote brush
<i>Eriophyllum staechadifolium</i>	Coastal golden yarrow
<i>Isocoma menziesii</i>	Coast goldenbush
<i>Lotus scoparius</i>	Deerweed

**5.3.2 Swale Plantings**

The new swale will convey storm runoff to the percolation basin, and will need to contain stable, deep rooted plants to prevent erosion during storm events. This area will be planted with both containers and a specific seed mix. Container plantings will consist of deep-rooted, mat-forming species intended to create a stable channel feature, and shrubs to stabilize upper bank areas. The seed mix will complement the container plants and provide additional cover and protection for the channel. The container and seed mix plant palette for the swale area consists of the native grass and forb species listed below. Plant counts, location, spacing details, and seed specifications are listed on Sheet 3 in Appendix A.

**Container Plant List**

<i>Artemisia douglasiana</i>	Mugwort
<i>Carex praegracilis</i>	Field sedge
<i>Prunus fasciculata punctata</i>	Sand almond
<i>Rosa californica</i>	California rose
<i>Rhamnus californicus</i>	Coffeeberry

**Seed Mix 5 (Swale)**

<i>Artemisia douglasiana</i>	Mugwort
<i>Baccharis pilularis</i>	Coyote brush
<i>Eriophyllum staechadifolium</i>	Coastal golden yarrow
<i>Isocoma menziesii</i>	Coast goldenbush
<i>Lotus scoparius</i>	Deerweed

### 5.3.3 Pump Station Plantings

The Mid-town Pump Station will be visible from Los Osos Valley Road, but will consist of an unfenced concrete pad with several low equipment access structures. No buildings or fences will be installed, and formal screen plantings are inappropriate. Areas immediately surrounding the Pump Station will be seeded with Seed Mix 4. Seed specifications are listed on Sheet 3 in Appendix A.

## 5.4 BRODERSON

Restoration of the Broderon site will consist of removing eucalyptus and cypress trees within and upslope of the leach field, planting and seeding the leach field area with native coastal scrub species, eliminating veldt grass from infested areas, re-establishing dominant coastal scrub habitat in infested areas, and hand removal of weeds in maritime chaparral habitat areas. This site is known to contain the federally protected Morro shoulderband snail, and all restoration work must meet the requirements of the USFWS Biological Opinion for the project. Construction of the leach field and temporary fencing to protect plantings will block several existing trails in the area; connector trails will be established to link active pathways during construction and revegetation.

The eucalyptus and cypress trees present within the leach field area will be removed to make room for leach field installation. Although out of the leach field site, eucalyptus trees immediately adjacent to and upslope of the site are negatively impacting coastal scrub habitat, and are spreading into adjacent maritime chaparral habitats. These trees should also be removed to improve success of coastal scrub restoration efforts, halt the current invasion of maritime chaparral, and reduce the potential for root intrusion and associated maintenance actions at the leach field. All trees removed shall be chipped and piled on-site or at Mid-town for use during planting efforts at all restoration sites that require installation of mulch as part of the planting process. Grow-and-kill activities at this site shall use only grass-specific herbicides: broadleaf herbicides shall not be used during grow-and-kill cycles without the approval of the Project Biologist.

### 5.4.1 Leach Field Coastal Scrub Restoration

Following grading and installation of the leach field, the leach field area will be planted and seeded with a mix of vigorous, early colonizer species intended to quickly occupy the bare area. This area will be planted with both containers and a specific seed mix. Container plants will be watered by drip irrigation. This area contains and is adjacent to various non-native grass species, including veldt grass, and will require use of grass-specific herbicide to keep weed growth under control during establishment. The seed mix for this site does not contain any grass species due to the need for ongoing control of invasive grass species. Plant counts, location, spacing details, and seed specifications are listed on Sheet 2 in Appendix A.

#### Container Plant List

<i>Artemisia californica</i>	California sage
<i>Baccharis pilularis</i>	Coyote brush
<i>Ceanothus cuneatus</i> var. <i>cuneatus</i>	Buckbrush
<i>Lupinus chamissonis</i>	Dune bush lupine
<i>Salvia mellifera</i>	Black sage

**Seed Mix 3 (No grass species)**

<i>Achillea millefolium</i>	Yarrow
<i>Artemisia californica</i>	California sage
<i>Baccharis pilularis</i>	Coyote brush
<i>Ericameria ericoides</i>	Mock heather
<i>Eriogonum parvifolium</i>	Sea-cliff buckwheat
<i>Eriophyllum staechadifolium</i>	Coastal golden yarrow
<i>Helianthemum scoparium</i>	Rushrose
<i>Isocoma menziesii</i>	Coast goldenbush
<i>Lotus scoparius</i>	Deerweed
<i>Lupinus chamissonis</i>	Dune bush lupine
<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Salvia mellifera</i>	Black sage

**5.4.2 Veldt Removal/Coastal Scrub Restoration**

The northern portion of the site below the leach field area contains remnant occurrences of coastal scrub species, but is dominated by veldt grass. Removal of veldt grass is necessary to re-establish dominant coastal scrub vegetation on the site. Veldt grass removal will be accomplished through repeated applications of grass-specific herbicide, timed to have maximum effect on mature plants and newly sprouted seedlings. The removal process is expected to take several years of diligent application to expose the soil and reduce the seed bank to a point where seeding of native species can occur. No container plants or irrigation will be installed in this area. Seed Mix 3, as listed above, will be used in this area. Seed specifications are provided on Sheet 2 in Appendix A.

**5.4.3 Maritime Chaparral Restoration**

The southern, higher elevation areas of the site are densely vegetated with maritime chaparral habitat, but veldt grass and other non-native species are present in some areas. The restoration effort will consist of manual removal of exotic species throughout the area. If determined to be necessary by the Project Biologist, grass-specific herbicide can be used in limited areas for control of severe veldt grass infestations. Large areas disturbed by hand or chemical weed removal will be broadcast seeded with Seed Mix 3. No container planting or irrigation will occur in this area. Seed specifications are provided on Sheet 2 in Appendix A.

**5.5 SOLANO**

Restoration of the Solano site will consist of removal of non-native species, seeding and planting to restore native habitats, and plantings to screen the facility. Planting will occur in natural areas located in the northern portion of the site, along the sidewalk, and within the existing fenced area disturbed by golf course activities. Restoration in natural areas will consist of planting scattered Pacific wax-leaf myrtle trees irrigated by drip lines, and seeding with Seed Mix 3 following removal of veldt grass. No planting or seeding will occur in natural areas dominated by field sedge: the only treatment in these areas will be weed removal conducted by hand.

Planting within the disturbed portions of the pump station site will occur in narrow beds between sidewalk and golf course cart paths, and will consist of container plants irrigated by drip lines. Bare ground areas around plantings along the sidewalk and inside the fence will be covered with mulch. The screen plantings will consist of the species listed below. Plant counts, location, spacing, and irrigation details are provided on Sheets 4 and 5 in Appendix A.

**Container Plant List**

<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Myrica californica</i>	Pacific wax-leaf myrtle
<i>Prunus ilicifolia</i>	Hollyleaf cherry
<i>Rhamnus californica</i>	Coffeeberry
<i>Rosa californica</i>	California rose

The Solano site contains non-native grass species, including veldt grass, and may require use of grass-specific herbicide to keep weed growth under control during establishment. If herbicides are used, care must be taken to avoid spraying the naturally occurring field sedge present along the northern edge of the restoration area. Required seed amounts are provided on Sheet 4 in Appendix A.

**Seed Mix 3 (No grass species)**

<i>Achillea millefolium</i>	Yarrow
<i>Artemisia californica</i>	California sage
<i>Baccharis pilularis</i>	Coyote brush
<i>Ericameria ericoides</i>	Mock heather
<i>Eriogonum parvifolium</i>	Sea-cliff buckwheat
<i>Eriophyllum staechadifolium</i>	Coastal golden yarrow
<i>Helianthemum scoparium</i>	Rushrose
<i>Isocoma menziesii</i>	Coast goldenbush
<i>Lotus scoparius</i>	Deerweed
<i>Lupinus chamissonis</i>	Dune bush lupine
<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Salvia mellifera</i>	Black sage

**5.6 EAST YSABEL**

Restoration of the East Ysabel site will consist of removal of non-native species and ornamental trees and installation of bank stabilization and screen plantings. This area will be planted with container plants irrigated by drip lines and a specific seed mix. Planting will occur on steep road banks, depressional areas in the middle of the site, and immediately adjacent to pump station structures. The screen plantings will consist of the species listed below. Plant counts, location, spacing, and irrigation details are provided on Sheets 6 and 7 in Appendix A.

**Container Plant List**

<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Myrica californica</i>	Pacific wax-leaf myrtle
<i>Prunus ilicifolia</i>	Hollyleaf cherry
<i>Rhamnus californica</i>	Coffeeberry
<i>Rosa californica</i>	California rose

The East Ysabel site contains and is adjacent to various non-native grass species, including veldt grass, and will require use of grass-specific herbicide to keep weed growth under control during establishment. The seed mix for this site does not contain any grass species due to the need for repeated control of invasive grass species. Required seed amounts are provided on Sheet 6 in Appendix A.

**Seed Mix 3 (No grass species)**

<i>Achillea millefolium</i>	Yarrow
<i>Artemisia californica</i>	California sage
<i>Baccharis pilularis</i>	Coyote brush
<i>Ericameria ericoides</i>	Mock heather
<i>Eriogonum parvifolium</i>	Sea-cliff buckwheat
<i>Eriophyllum staechadifolium</i>	Coastal golden yarrow
<i>Helianthemum scoparium</i>	Rushrose
<i>Isocoma menziesii</i>	Coast goldenbush
<i>Lotus scoparius</i>	Deerweed
<i>Lupinus chamissonis</i>	Dune bush lupine
<i>Mimulus aurantiacus</i>	Bush monkey flower
<i>Salvia mellifera</i>	Black sage

**5.7 PERMANENT FENCING AND SIGNAGE**

Permanent fencing and signage will be installed where appropriate to protect restoration areas and provide information for the public. Fencing will be designed to restrict or guide human access without affecting wildlife passage. Fencing shall be repaired and/or replaced when necessary.

Informational signs will be placed in suitable locations along perimeter fencing and existing and proposed trails at the Broderson and Mid-town sites. Sign text will notify the public that the area contains a sensitive habitat restoration area, discuss the biological value of the protected habitats and the purpose and goals of the restoration efforts, and state that activities or entrance other than use of the foot path is restricted.

**6. CONSTRUCTION MONITORING**

The County will provide a qualified biologist or restoration specialist to monitor implementation of the HMP. Duties include directing protective fencing installation, conducting training for grading contractors, monitoring grading activities, directing weed eradication and planting efforts, irrigation system approval, and documentation of construction, planting, and maintenance activities.

**7. MAINTENANCE**

Following establishment, County maintenance staff will be responsible for care and maintenance of the restoration areas. Maintenance activities necessary to ensure that the project objectives are achieved include:

- regular removal of invasive or exotic plants before seed is set;
- revegetation of areas where damage has occurred or plant cover deficiencies are identified;
- prevention of damage to plants from herbivores and human activities;
- apply irrigation as appropriate for prevailing weather conditions;
- maintain the irrigation system in good repair;
- regular removal of trash and debris;
- repair of erosion or vandalism damage; and,
- repair fencing and signage as necessary.

## 7.1 WEED CONTROL AFTER ESTABLISHMENT

Exotic species removal will occur during site preparation; however, periodic weed abatement will be required throughout the life of the project. The restoration areas are subject to introduction of weed species from soil seed banks and from surrounding residential and open space areas. Noxious weeds expected to require ongoing attention consist primarily of *Ehrharta calycina*, and may also include *Picris echioides*, *Silybum marianum*, *Carduus pycnocephalus*, *Centaurea solstitialis*, or any other species listed on the California Invasive Plant Council's Invasive Plant Inventory that is found in numbers sufficient to require control through herbicide. A list of expected weed species and best management practices is included in Appendix D. Weed control efforts shall follow the requirements below:

- All weeding and herbicide application shall be performed under the direction of the Project Biologist.
- Weed control should focus on removal before weed plants set seed.
- All seed heads present during weeding activities should be removed by carefully clipping and bagging seed heads and disposing of them off-site.
- Maintenance staff performing weeding must have training in plant identification and low impact weed removal techniques.
- Care must be taken to identify and avoid removal of volunteer native species during maintenance activities.

Both manual and chemical methods will be used to remove weeds following establishment. Manual weed control methods will be implemented within a 3-foot diameter plot around any native plant species present. Chemical weed control efforts will be implemented to combat noxious weed species in areas located outside of the 3-foot boundary. Weeding activities will be coordinated with target species' seasonal germination and growth patterns; therefore, the schedule will depend on the target species. Typically, weed abatement intensity will be highest in the spring and less in the summer and fall (refer to Appendix D).

## 7.2 SUPPLEMENTAL WATERING

Water will be supplied to container plantings and oak acorn planting locations on an as-needed basis determined by the County. Supplemental water will be supplied by a drip irrigation system, or by hand via a water truck. Watering should be controlled so only enough is used to initially establish the plantings and reduced to zero over the life of the program. All supplemental watering will be performed in a manner that ensures deep penetration of water to the soil around the rootball (not on the foliage). To avoid over watering in the winter months, irrigation systems should be turned off prior to December 1 of each year.

## 7.3 DEBRIS REMOVAL AND VANDALISM REPAIR

The restoration sites will be subject to varied degrees of human encroachment from trails, roads, and nearby private lands. Dumping and vandalism are not expected to be significant problems, but windblown trash may accumulate in planted areas. Trash removal and vandalism repair will occur as needed during scheduled maintenance visits to restoration sites.

## 7.4 REPLANTING

If during the initial five-year interim monitoring period the survival rate of the plantings falls below 75 percent, the County will replant the needed number of containers to obtain the required 75 percent survival rate. All supplemental plantings will be maintained and monitored until they are determined to be self-sustaining. Additional seed collection and hand seeding can also be performed if deemed appropriate by the County as a measure to increase the total plant coverage. No planting shall be conducted once long-term/final success criteria have been met, unless a catastrophic occurrence removes a large percentage of plantings on a site.

## 8. SUCCESS CRITERIA

The HMP includes overall interim and long-term/final success criteria for the combined restoration areas covered by the Plan, and general criteria specific to each habitat type restored. Success of the restoration effort will be determined through analysis of monitoring data and comparison with the criteria listed below. If it becomes evident that HMP areas are not achieving the success criteria, the County will determine the reasons for the deficiencies and adjust management actions as necessary.

### 8.1 INTERIM SUCCESS CRITERIA

Interim success will be determined annually for each site following implementation of the HMP and establishment of all plantings. The interim period will continue for five years or until all interim criteria are met.

**Table 2. Interim Success Criteria**

Attribute	Year 1	Year 2	Year 3	Year 4	Year 5
Total Percent of Native Cover Present	20%	30%	40%	55%	65%
Average Vigor Rating*	2	2	2	2	2
Plant Survival	90%	85%	80%	80%	75%
Percent of Non-Native Cover	15%	15%	10%	10%	5%

\*Plant health and vigor will be measured as follows:

- 1 = excellent – vigorous healthy plant (no necrotic or chlorotic leaves)
- 2 = good – plant healthy with limited signs of vigorous growth
- 3 = adequate – plant healthy, but with no signs of vigorous growth, and some necrosis or other damage present
- 4 = poor – low vitality, or main stem dead but basal sprouts emerging
- 5 = dead – no evidence of recovery

Notes:

- Nursery stock plant survivorship may include original plantings, remedial plantings, or native volunteer species.
- Any remedial plantings will be monitored until the restoration specialist determines that they are self-sustaining.
- Percent non-native cover calculations exclude non-native annual grasses considered part of the California Annual Grassland Series.

## 8.2 LONG-TERM/FINAL SUCCESS CRITERIA

Achievement of the interim success criteria will indicate that the site has developed into a self-sustaining pattern that should continue over the long term with minimal maintenance inputs. Achievement of long-term/final success will be determined following three years of no maintenance inputs to the restoration sites other than removal of non-native species. Long-term/final success will consist of establishment of stable natural habitat conditions over the restoration sites that are visibly more diverse and contain significantly fewer exotic species than surrounding similar habitats. All areas restored under the HMP will be required to maintain the conditions specified by the long-term/final success criteria in perpetuity.

**Table 3. Long-Term/Final Success Criteria**

Attribute	Criteria
Total Percent of Native Cover Present	70+
Plant Survival Percent	70+
Average Vigor Rating	2
Percent of Non-Native Cover	5

## 8.3 HABITAT-SPECIFIC SUCCESS CRITERIA

In addition to the specific interim and long-term/final criteria listed above, the following general standards will also be assessed for each habitat type to be restored.

### 8.3.1 Oak Plantings

Each area planted with oak acorns at the Giacomazzi site shall have at least one live oak tree (vigor rating of 2 or better) in each planting zone five years after planting. All container planted oaks shall be alive and have a vigor rating of 2 or better five years after planting. No non-native species shall be present within the dripline of oak trees planted for this HMP.

### 8.3.2 Drainage Repair Areas

Riparian areas repaired and restored at Giacomazzi shall maintain a dominant, multi-level cover of native riparian and coastal scrub plant species, with exotic weed percentages constituting no more than five percent of the total plant coverage. These areas should exhibit evidence of native plant recruitment and wildlife usage. No erosion should be evident in these areas.

### 8.3.3 Coastal Scrub Areas

All non-screen areas planted or seeded with coastal scrub species shall maintain a dominant, multi-level cover of native shrub, forb, and perennial and annual grass species, with exotic weed percentages constituting no more than five percent of the total plant coverage. These areas should exhibit evidence of native plant recruitment and wildlife usage, including presence of Morro shoulderband snail.

### 8.3.4 Maritime Chaparral Areas

Maritime chaparral areas at the Broderson site shall maintain a dominant, multi-level cover of native tree, shrub, forb, and perennial and annual grass species, with exotic weed percentages constituting no more than five percent of the total plant coverage. These areas should exhibit evidence of native plant recruitment and wildlife usage.

## 9. MONITORING

The County will monitor and maintain the restoration areas per the schedules presented in this HMP to ensure success of the restoration effort. Monitoring shall document overall site conditions, and will note species diversity, total ground cover of vegetation, vegetative cover of dominant species, wildlife usage, hydrology, and presence and abundance of sensitive species or other individual “target” species, and weed occurrences within the restoration areas. The scheduled monitoring program will provide qualitative and quantitative data for use in determining the success of the restoration program, based on the relationship between observed site conditions and the established success criteria.

Qualitative assessments will include evaluations of plant vigor, damage, exotic species competition, and erosion, and will be documented by photos taken from established photo points. These attributes will be evaluated to determine the need to adjust management actions such as increasing or decreasing supplemental water, applying pesticides, the need for ungulate exclusion, or increasing weed abatement efforts.

Quantitative assessments will include calculating planting survivorship, evaluating the percent cover of each habitat type, and evaluating the percent cover of exotic species. The number of surviving plantings will be divided by the number of plantings installed to determine survivorship percentage. Volunteer plants will also be counted if it is reasonable to assume they are viable.

### 9.1 MONITORING AND MAINTENANCE SCHEDULES

Monitoring and maintenance schedules for both the five-year Interim period and the Long-Term/Final period are presented below.

**Table 4. LOWWP Restoration Areas Five-Year Interim Schedule**

YEAR: 1-5	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<b>ANNUAL TASKS</b>												
Weeding/Maintenance		X	X	X		X			X			X
Revegetation Monitoring					X							
Annual Report												X

**Table 5. LOWWP Restoration Areas Long-Term Schedule**

YEAR: 10, 15, 20...	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<b>TASKS</b>												
Annual Weeding (every year as needed)		X		X			X					
Qualitative & Quantitative Monitoring Assessment (every 5 years)					X							X
Monitoring Report (every 5 years)												X

## 9.2 MONITORING METHODS

The monitoring program will provide qualitative and quantitative data to be used in determining the successes of the enhancement program. The restoration specialist will collect and evaluate data indicating the relationship between actual site conditions and the established success criteria.

### 9.2.1 Qualitative Assessments

Qualitative assessments will be conducted annually in the spring and will include evaluations of the plantings vigor, damage, and exotic species competition, and photo documentation. These attributes will be evaluated to determine the need to adjust management actions, such as increasing or decreasing supplemental water, applying pesticides, the need for ungulate exclusion, and increasing weed abatement.

Planting vigor will be rated from 1 (excellent) to 5 (dead) pursuant to the ratings provided in Table 2. On average the plantings should exhibit vigor ratings of 1 or 2 throughout the seasons. If the vigor rating for individuals or portions of the plantings on a site falls below 2, remedial actions will be necessary.

Permanent photo points will be established at each restoration site to assist in tracking the success of the HMP, and to provide meaningful photo documentation in monitoring reports. Permanent photo points will be established during the preparation of each site, and ground view photos will be taken during each monitoring year from the same vantage points.

### 9.2.2 Quantitative Assessments

Quantitative assessments will be conducted annually in the spring, during the Interim Monitoring period, and will include calculating planting survivorship, evaluating the percent cover in each habitat area, and evaluating the percent cover of exotic species. Percent cover shall be documented in spring of each year, and percent cover calculations will be used to document plant cover over planted and seeded areas. A planting will be considered “surviving” if at least half of the foliage or stem (if deciduous) is green and flexible (Vigor of 1 to 4). Due to the size of the planting areas at Giacomazzi, Mid-town, and Broderson, plant survival shall be estimated through visual observation instead of counting. The number of estimated surviving plantings will be divided by the number of plantings installed. Volunteer plants will be counted if it is reasonable to assume they are offspring of the plantings or if they are present in an area where a native plant was planted. Percent cover must be determined by a documented method. Several methods are available; however, this HMP recommends utilizing the Daubenmire or Line Intercept Methods as describe by *Sampling Vegetation Attributes* (Natural Resources Conservation Service [NRCS] 1996). Examples and data sheets for the recommended methods are provided in Appendix C.

## 9.3 ANALYSIS OF MONITORING RESULTS

Data obtained during transect analysis and qualitative monitoring observations will be documented in annual reports. Quantitative data collected using the methods recommended above will be suitable for statistical analysis, in case such analysis is warranted. Evaluation of documented results over the monitoring period will expose any patterns or trends in vegetative condition, and will identify areas and actions needed. Identified problem areas will be addressed through adaptive management analysis to identify suitable remedial action.

## 9.4 REMEDIAL ACTIONS

Identified problem areas (e.g., weed infestations, erosion damage, plant loss, vandalism) will be corrected as needed through normal maintenance actions. If the site trends indicate that the success criteria will eventually be established in a longer time frame than anticipated, maintenance and monitoring will continue until success is established. If a total site failure is evident, the County will, in consultation with

the California Coastal Commission, determine what corrective action(s) should be taken and will subsequently implement those action(s).

## **10. MONITORING REPORTS**

The reporting schedule includes an as-built report to be submitted within 30 days of implementation, an annual report cycle during the interim monitoring period, and an every five-year reporting cycle once long-term/final success criteria have been achieved. The County will ensure that all reports are submitted to the Coastal Commission and interested agencies.

### **10.1 AS-BUILT REPORTING**

An “as built” report documenting site conditions shall be prepared and submitted to the Coastal Commission Executive Director within 30 days of completion of the initial restoration activities. The report shall describe the field implementation of the approved restoration program in narrative and photographs, and report any problems in the implementation and their resolution.

### **10.2 ANNUAL REPORTING**

An annual monitoring report shall be prepared by December 31 of each year during the five-year interim monitoring period. Annual monitoring reports will summarize site conditions, maintenance practices, and results documented during regular maintenance and field sampling visits, and include a discussion of success or failure, based on collected data. Photo documentation will be included in all annual reports. Two copies of each annual report shall be submitted to the California Coastal Commission Executive Director in December of each year of interim period monitoring.

### **10.3 FIVE-YEAR REPORTING**

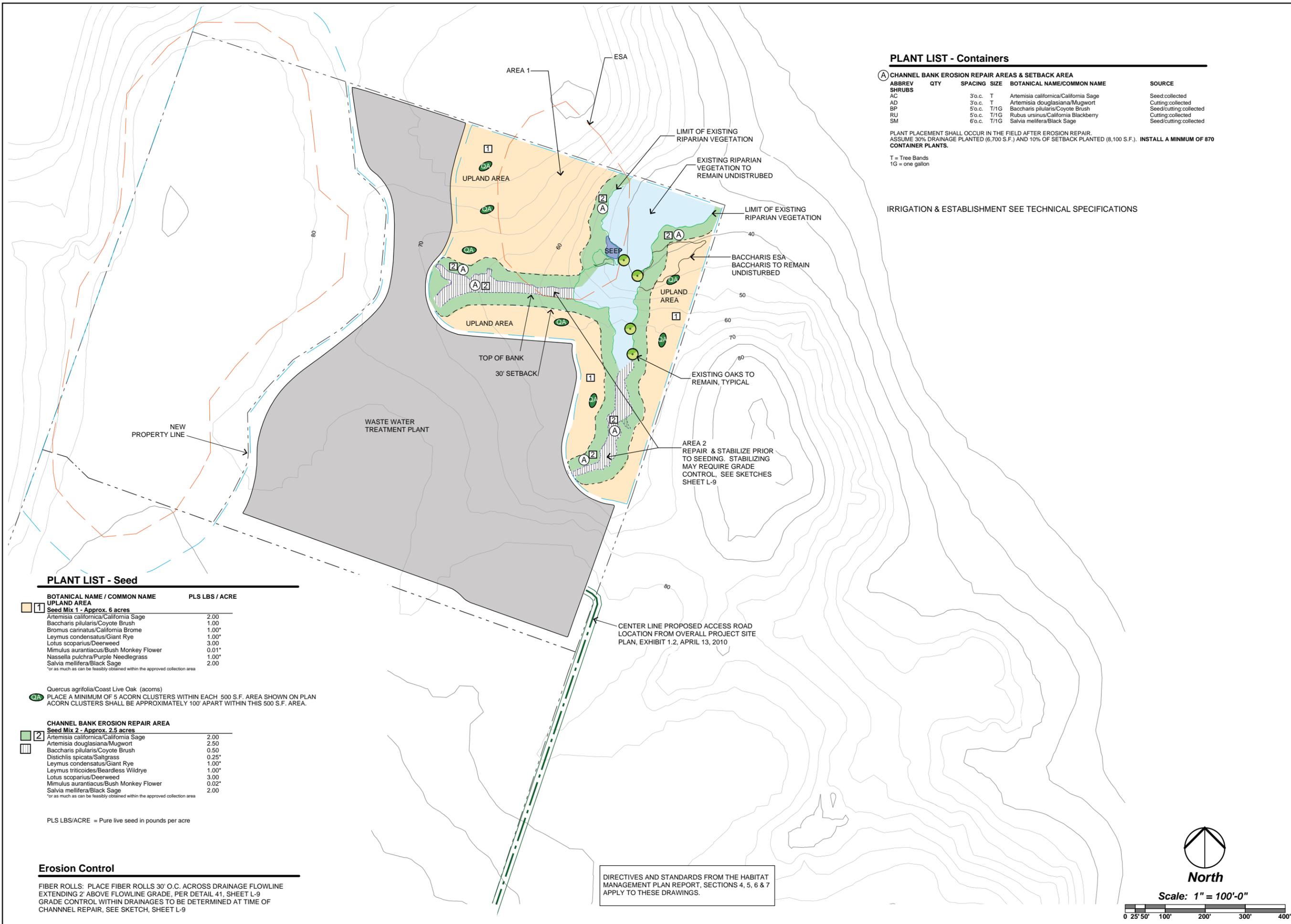
Following achievement of the Interim Success Criteria, monitoring and reporting will occur on a five-year schedule. Five-year reports will follow the format and include all information normally presented in the annual reports, and shall be submitted to the Executive Director in December following monitoring. Five-year reports will specifically discuss any significant successional changes observed in the restoration areas, and will provide long-term maintenance and management recommendations for the site.

## 11. REFERENCES

- California Native Plant Society (CNPS). 2011. Inventory of Rare and Endangered Plants (online edition). California Native Plant Society. Sacramento, CA. Accessed on Wed., Mar. 16, 2011 from <http://www.cnps.org/inventory>
- Emery, Dara E. 1995. *Seed Propagation of Native Plants*. Santa Barbara Botanic Garden. Santa Barbara, California.
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- Howald, Ann M. 1990. *Mitigation Plan Annotated Outline for Endangered Plants of California*. California Department of Fish and Game Endangered Plant Program. Sacramento, California.
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- U.S. Department of Agriculture Natural Resource Conservation District (NRCS). 1984. Soil Conservation Service. Soil Survey of San Luis Obispo County, California, Coastal Part.

**APPENDIX A:  
Landscape Plans and Specifications**





**PLANT LIST - Containers**

ABBREV	QTY	SPACING	SIZE	BOTANICAL NAME/Common Name	SOURCE
AC		3'o.c.	T	Artemisia californica/California Sage	Seed/collected
AD		3'o.c.	T	Artemisia douglasiana/Mugwort	Cutting/collected
BP		5'o.c.	T/1G	Baccharis pilularis/Coyote Brush	Seed/cutting/collected
RU		5'o.c.	T/1G	Rubus ursinus/California Blackberry	Cutting/collected
SM		6'o.c.	T/1G	Salvia mellifera/Black Sage	Seed/cutting/collected

PLANT PLACEMENT SHALL OCCUR IN THE FIELD AFTER EROSION REPAIR. ASSUME 30% DRAINAGE PLANTED (6,700 S.F.) AND 10% OF SETBACK PLANTED (8,100 S.F.). INSTALL A MINIMUM OF 870 CONTAINER PLANTS.

T = Tree Bands  
1G = one gallon

IRRIGATION & ESTABLISHMENT SEE TECHNICAL SPECIFICATIONS

**PLANT LIST - Seed**

BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
<b>1 UPLAND AREA</b>	
<b>Seed Mix 1 - Approx. 6 acres</b>	
Artemisia californica/California Sage	2.00
Baccharis pilularis/Coyote Brush	1.00
Bromus carinatus/California Brome	1.00*
Leymus condensatus/Giant Rye	1.00*
Lotus scoparius/Deerweed	3.00
Mimulus aurantiacus/Bush Monkey Flower	0.01*
Nassella pulchra/Purple Needlegrass	1.00*
Salvia mellifera/Black Sage	2.00

Quercus agrifolia/Coast Live Oak (acorns)  
PLACE A MINIMUM OF 5 ACORN CLUSTERS WITHIN EACH 500 S.F. AREA SHOWN ON PLAN. ACORN CLUSTERS SHALL BE APPROXIMATELY 100' APART WITHIN THIS 500 S.F. AREA.

BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
<b>2 CHANNEL BANK EROSION REPAIR AREA</b>	
<b>Seed Mix 2 - Approx. 2.5 acres</b>	
Artemisia californica/California Sage	2.00
Artemisia douglasiana/Mugwort	2.50
Baccharis pilularis/Coyote Brush	0.50
Distichlis spicata/Saltgrass	0.25*
Leymus condensatus/Giant Rye	1.00*
Leymus triticoides/Beardless Wildrye	1.00*
Lotus scoparius/Deerweed	3.00
Mimulus aurantiacus/Bush Monkey Flower	0.02*
Salvia mellifera/Black Sage	2.00

PLS LBS/ACRE = Pure live seed in pounds per acre

**Erosion Control**

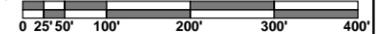
FIBER ROLLS: PLACE FIBER ROLLS 30' O.C. ACROSS DRAINAGE FLOWLINE EXTENDING 2' ABOVE FLOWLINE GRADE, PER DETAIL 41, SHEET L-9. GRADE CONTROL WITHIN DRAINAGES TO BE DETERMINED AT TIME OF CHANNEL REPAIR, SEE SKETCH, SHEET L-9

DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.



North

Scale: 1" = 100'-0"



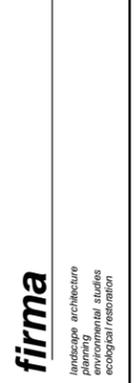
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Owner:  
County of San Luis Obispo  
Department of General Services  
1087 Santa Rosa Street  
San Luis Obispo, California

Project:  
Los Osos Wastewater Project  
Habitat Management Plan

Sheet Title:  
Giacomazzi Site  
Planting Plan

Principal: David W. Frote ASLA  
Registration No. 27107  
107 Torr Lane, San Luis Obispo CA 93401  
805.781.9600 fax 805.781.9603



job no.	21035
plan check issue date:	5/12/11
bid set issue date:	

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**1**  
OF SHEETS



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Owner:  
 County of San Luis Obispo  
 Department of General Services  
 1087 Santa Rosa Street  
 San Luis Obispo, California

Project:  
 Los Osos Wastewater Project  
 Habitat Management Plan

Sheet Title:  
 Broderson Site  
 Planting Plan

Principal: David W. Frote ASLA  
 Registration No. 2130  
 187 Park San Luis Obispo CA 93401  
 805.781.9800 fax 805.781.9803



job no.	21035
plan check issue date:	5/12/11
bid set issue date:	

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 OF SHEETS

**PLANT LIST - Seed**

BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
<b>DISPOSAL SITE &amp; VELDT GRASS REMOVAL</b>	
<b>Seed Mix 3 - Approx. 19 AC</b>	
Achillea millefolium/Yarrow	2.00
Artemisia californica/California Sage	0.50
Baccharis pilularis/Coyote Brush	0.05
Ericameria ericoides/Mock Heather	1.50
Eriogonum parvifolium/Sea-cliff Buckwheat	1.50
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.50
Helianthemum scoparium/Rushrose	0.50*
Isocoma menziesii/Coast Goldenbush	2.00
Lotus scoparius/Deerweed	3.00
Lupinus chamissonis/Dune Bush Lupine	2.50
Mimulus aurantiacus/Bush Monkey Flower	0.02*
Salvia mellifera/Black Sage	2.00

**3 UPLAND AREA SEEDING & WEED REMOVAL PROGRAM**  
 Species listed above shall be hand scattered in areas where invasives will be removed. Exact location and extent of seeding to be determined in the field at time of disposal site construction. Contractor to provide unit price per square foot to implement this program.

PLS LBS/ACRE = Pure live seed in pounds per acre

DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.

**PLANT LIST - Containers**

ABBREV	SPACING	SIZE	BOTANICAL NAME/COMMON NAME	SOURCE
<b>DISPOSAL SITE</b>				
AC	3'o.c.	T	Artemisia californica/California Sage	Seed/collected/vendor
BP	5'o.c.	T/1G	Baccharis pilularis/Coyote Brush	Seed/cutting/collected/vendor
CC	6'o.c.	T/1G	Ceanothus cuneatus var. cuneatus/Buckbrush	Cutting/collected
LC	6'o.c.	T	Lupinus chamissonis/Dune Bush Lupine	Seed: collected/vendor
SM	5'o.c.	T	Salvia mellifera/Black Sage	Seed/Cutting: collected/vendor

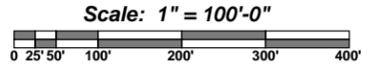
T = Tree Band  
 1G = one gallon

INSIDE FENCED DISPOSAL SITE **INSTALL 1,500 CONTAINER PLANTS**. INSTALL APPROXIMATELY FIFTY GROUPS WITH APPROXIMATELY 30 PLANTS IN EACH GROUP. EACH GROUP OF 30 PLANTS SHALL HAVE APPROXIMATELY SIX OF EACH SPECIES. LOCATE EACH GROUP OF PLANTS GREATER THAN 100' FROM ADJACENT GROUPS.

● LINK EXISTING PATH TO NEW PATH

ALL MATERIAL FROM TREE REMOVALS SHALL BE CHIPPED AND STOCKPILED ON SITE FOR USE AS MULCH WHERE DESIGNATED ON HMP SITES.

IRRIGATION & ESTABLISHMENT SEE TECHNICAL SPECIFICATIONS





**PLANT LIST - Seed**

BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
<b>DISTURBED UPLAND AREA</b>	
<b>4 Seed Mix 4 - Approx. 7 acres</b>	
Achillea millefolium/Yarrow	2.50
Artemisia californica/California Sage	2.75
Baccharis pilularis/Coyote Brush	0.75
Ericameria ericoides/Mock Heather	3.75
Eriogonum parvifolium/Sea-cliff Buckwheat	3.25
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.75
Lotus scoparius/Deerweed	7.50
Lupinus chamissonis/Dune Bush Lupine	3.50
Salvia mellifera/Black Sage	3.00

BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
<b>PERCOLATION BASIN &amp; SWALE</b>	
<b>5 Seed Mix 5 - Approx. 2.8 acres</b>	
Artemisia douglasiana/Mugwort	3.50
Baccharis pilularis/Coyote Brush	0.75
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.75
Isocoma menziesii/Coast Goldenbush	4.25
Lotus scoparius/Deerweed	7.50

PLS LBS/ACRE = Pure live seed in pounds per acre

**Irrigation:**  
 COUNTY OF SAN LUIS OBISPO SHALL SUPPLY WATER TO FACILITATE ESTABLISHMENT OF CONTAINER PLANTS. WATER SOURCE AND METHOD OF APPLICATION TO BE DETERMINED

SEEDING SHALL OCCUR PRIOR TO RAINY SEASON, USING SEASONAL PRECIPITATION TO GERMINATE AND ESTABLISH PLANTS.

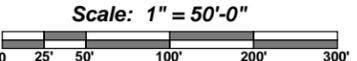
**Erosion Control:**  
 TO BE DETERMINED WHEN PRECISE PLANS ARE COMPLETED BY SAN LUIS OBISPO COUNTY.

**PLANT LIST - Containers**

ABBREV	SPACING	BOTANICAL NAME/COMMON NAME	QTY./SIZE	SOURCE
<b>D CHANNEL BANK EROSION CONTROL SHRUBS</b>				
AD	3'o.c.	Artemisia douglasiana/Mugwort	200 treebands	seed
CP	1'o.c.	Carex praegracilis/Field sedge	500 treebands	division
PF	3'o.c.	Prunus fasciculata/Sand almond	143 gallons	cutting
RC	6'o.c.	Rosa californica/California rose	143 treebands	cutting
RhC	6'o.c.	Rhamnus californica/Coffeeberry	250 treebands	seed

PLANT 60% OF SWALE (7,800 S.F.) WITH CONTAINER PLANTS. INSTALL 1,236 PLANTS IN SWALE AREA. LOCATE GROUPS OF 25 TO 40 PLANTS EVENLY THROUGHOUT THE LENGTH OF THE SWALE. EACH GROUP OF 25 TO 40 SHALL CONSIST OF A BLANCD MIX OF THE FIVE SPECIES.

DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.



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Owner:  
 County of San Luis Obispo  
 Department of General Services  
 1087 Santa Rosa Street  
 San Luis Obispo, California

Project:  
 Los Osos Wastewater Project  
 Habitat Management Plan

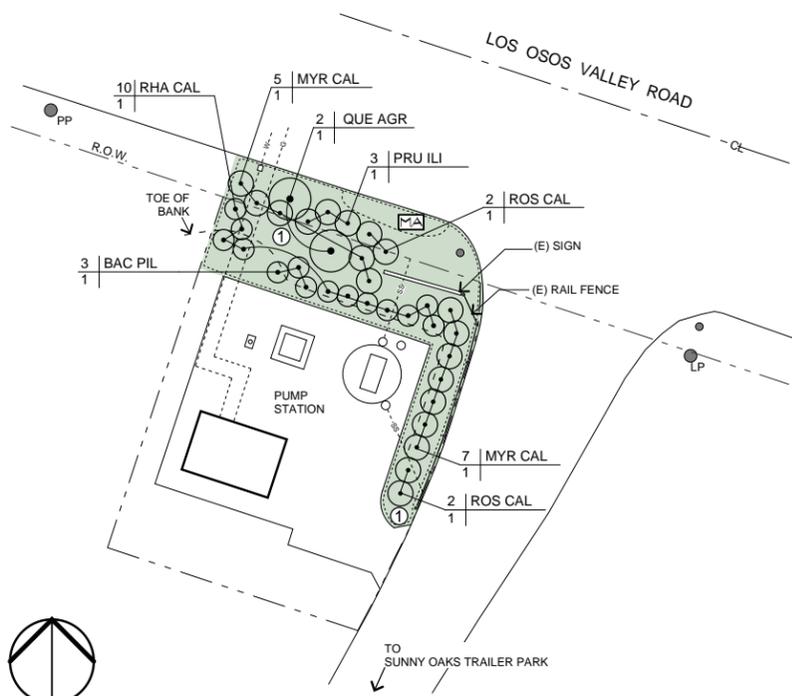
Sheet Title:  
 Mid-Town Site  
 Planting Plan

Principal: David W. Frote ASLA  
 Registration No. 27920  
 107 Park Street  
 San Luis Obispo CA 93401  
 805.781.9680 fax 805.781.9603



job no.	21035
plan check issue date:	5/12/11
bid set issue date:	

SHEET  
**3**  
 OF SHEETS



Sunny Oaks Pump Station

**PLANT LIST - Containers**

ABBREV TREES	SPACING	SIZE	BOTANICAL NAME/Common Name	SOURCE
QUE AGR		T	Quercus agrifolia/California Live Oak	Acorns:collected
SHRUBS				
BAC PIL	3'o.c.	T/1G	Mimulus aurantiacus/Bush Monkey Flower	Seed/cutting:collected
MYR CAL	5'o.c.	T/1G	Baccharis pilularis/Coyote Brush	Seed/cutting:collected/vendor
PRU ILI	6'o.c.	T/1G	Myrica californica/Pacific Wax-leaf Myrtle	Cutting:collected
RHA CAL	6'o.c.	T/1G	Prunus ilicifolia/Hollyleaf Cherry	Seed/cutting:collected/vendor
ROS CAL	5'o.c.	T/1G	Rhamnus californica/Coffeeberry	Cutting:collected
ROS CAL	6'o.c.	T/1G	Rosa californica/California Rose	Cutting:collected

T = tree band  
1G = one gallon

NOTES:  
① MULCH WITH 4" DEEP MATERIAL NOTED IN PLANTING SPECIFICATIONS

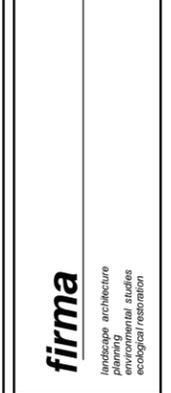
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Owner:  
County of San Luis Obispo  
Department of General Services  
1087 Santa Rosa Street  
San Luis Obispo, California

Project:  
Los Osos Wastewater Project  
Habitat Management Plan

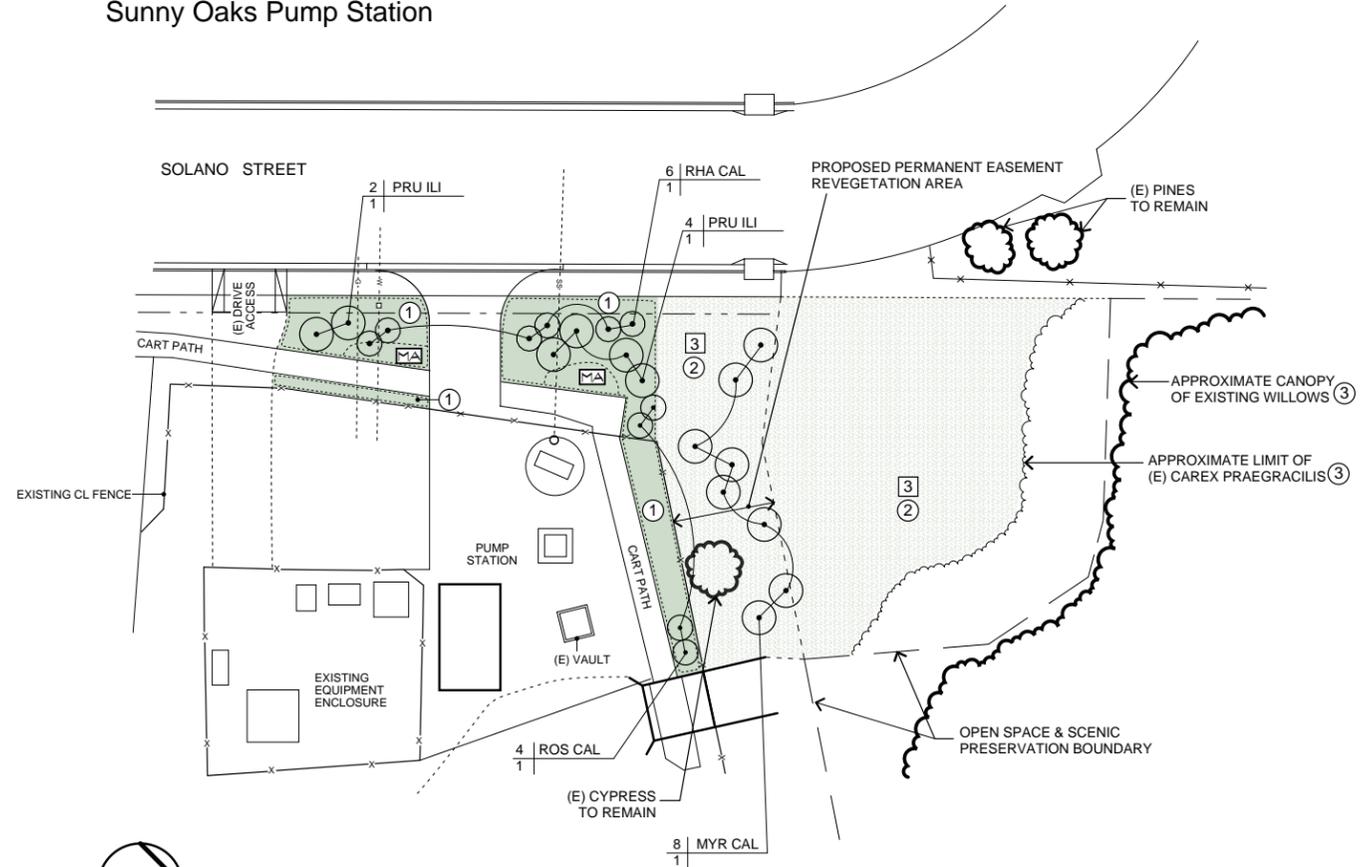
Sheet Title:  
Sunny Oaks & Solano  
Pump Stations  
Planting Plan

Principal: David W. Frote ASLA  
Registration No. 27120  
187 Park Street, San Luis Obispo, CA 93401  
805.781.9600 fax 805.781.9603



job no.	21035
plan check issue date:	5/12/11
bid set issue date:	

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OF SHEETS



Solano Pump Station

**PLANT LIST - Containers**

ABBREV SHRUBS/PERENNIALS	SPACING	SIZE	BOTANICAL NAME/Common Name	SOURCE
QUE AGR	3'o.c.	T/1G	Mimulus aurantiacus/Bush Monkey Flower	Seed/cutting:vendor/collected
MYR CAL	6'o.c.	T/1G	Myrica californica/Pacific Wax-leaf Myrtle	Cutting:collected
PRU ILI	6'o.c.	T/1G	Prunus ilicifolia/Hollyleaf Cherry	Cutting:collected
RHA CAL	5'o.c.	T/1G	Rhamnus californica/Coffeeberry	Cutting:collected
ROS CAL	6'o.c.	T/1G	Rosa californica/California Rose	Cutting:collected

T = tree band  
1G = one gallon

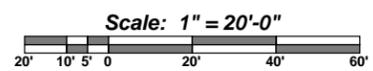
**PLANT LIST - Seed**

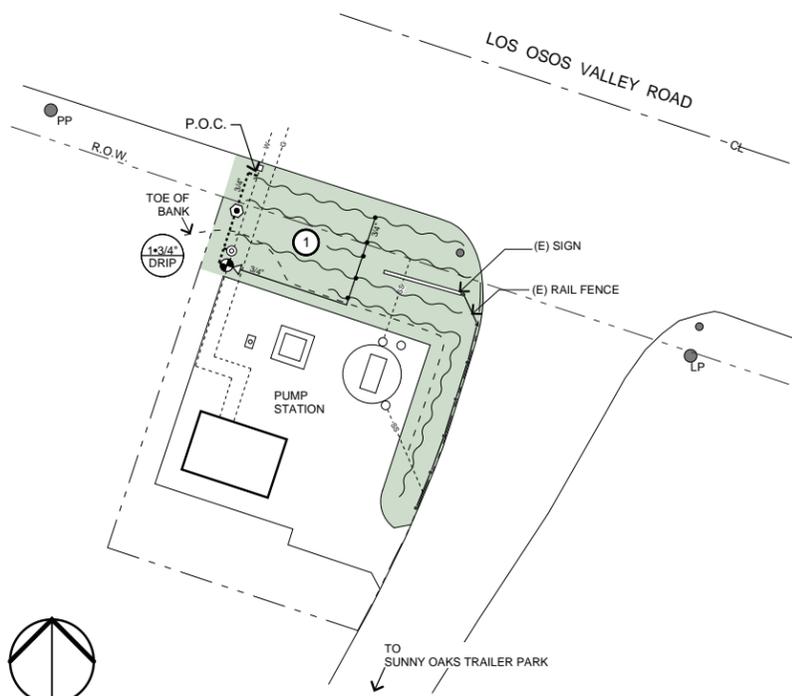
BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
3 Seed Mix 3 - 0.15 AC	
Achillea millefolium/Yarrow	2.00
Artemisia californica/California Sage	0.50
Baccharis pilularis/Coyote Brush	0.05
Ericameria ericoides/Mock Heather	1.50
Eriogonum parvifolium/Sea-cliff Buckwheat	1.50
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.50
Helianthemum scoparium/Rushrose	0.50*
Isocoma menziesii/Coast Goldenbush	2.00
Lotus scoparius/Deerweed	3.00
Lupinus chamissonis/Dune Bush Lupine	2.50
Mimulus aurantiacus/Bush Monkey Flower	0.02*
Salvia mellifera/Black Sage	2.00

\*or as much as can be feasibly obtained within the approved collection area

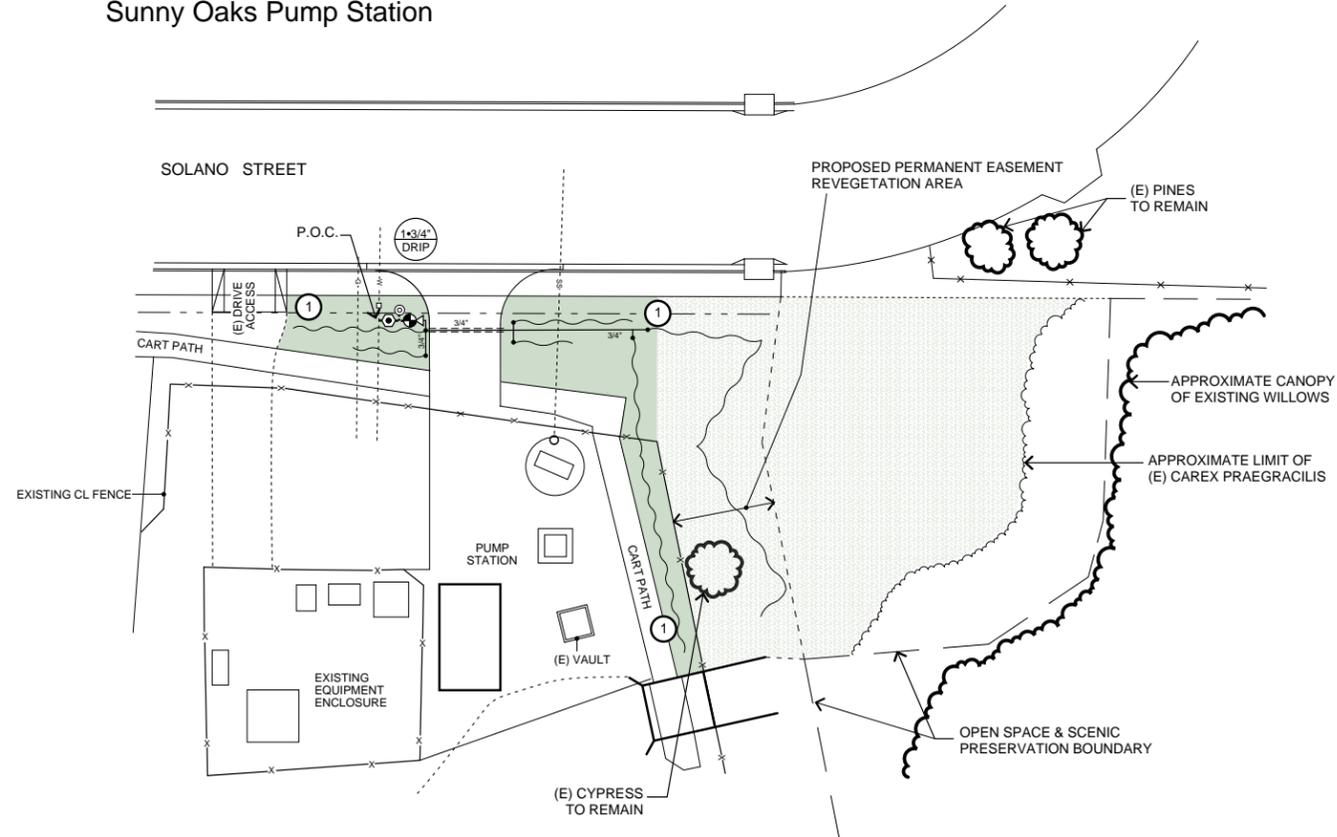
NOTES:  
① MULCH WITH 4" DEEP MATERIAL NOTED IN PLANTING SPECIFICATIONS  
② REMOVE ORNAMENTAL AND INVASIVE PLANTS, INCLUDING BUT NOT LIMITED TO ARUNDO DONAX, VELDT GRASS, RHAPHIOLEPIS.  
③ EXISTING NATIVE PLANTS SHALL REMAIN IN PLACE AS PERMITTED BY CONSTRUCTION AND PLANT REMOVALS.

DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.





Sunny Oaks Pump Station



Solano Pump Station

### Irrigation Schedule

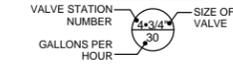
SYMBOL	DESCRIPTION	MODEL	NOTES
□	CONTROLLER	IRRITROL IBOC 100 with BAT10 battery	Dtl. 10,L-8
⊙	R.P. BACKFLOW	WILKINS 975XL - 3/4"	Dtl.11,L-8
⊕	ELECTRIC CONTROL VALVE (DRIP)	IRRITROL 700 SERIES ULTRAFLOW, size per plan	Dtl. 10,L-8
△	PRESSURE REGULATOR	WILKINS 500YSBR SERIES	Dtl. 20,L-8
⊖	FILTER (DRIP)	AG PRODUCTS #4E, Size to match valve	Dtl. 20,L-8
⊗	QUICK COUPLER VALVE	RAINBIRD 33DRC w/ 33K	Dtl. 22,L-8
⊗	SHUTOFF VALVE	NIBCO T-560 BALL VALVE	Dtl. 23,L-8
⊗	FLUSH VALVE	AG PRODUCTS 3/4-B BALL VALVE	Dtl. 21,L-8
⊗	CHECK VALVE	KBI CV-SIZE PER PIPE, AS NEEDED (SEE NOTES)	
---	PRESSURE LINE	SCHEDULE 40 PVC, 18" Deep	Dtl. 912,L-8
---	DRIP PVC LATERAL	CLASS 200 PVC w/ DRIP TUBE ADAPTOR	Dtl. 30-33,L-8
①	DRIP ZONE	RAINBIRD XBS POLYETHYLENE HOSE .615" I.D.	Dtl. 30-33,L-8
---	PVC SLEEVE	PVC SCH 40, 2x LINE SIZE	

### EMITTER SCHEDULE

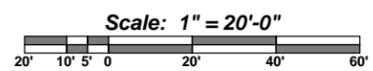
Plant Size	Emitter	Number Per Plant
1 G	1 GPH EMITTER	2
5 G	2 GPH EMITTER	2
15 G	1 GPH EMITTER	4

- SLEEVE UNDER ALL PAVING PER SPECIFICATIONS.
- LATERAL & MAINLINE LOCATIONS ARE SCHEMATIC. LOCATE PIPING IN PLANTER ADJACENT TO PAVING EDGE.
- KING BROTHERS IN-LINE CHECK VALVE SHALL BE INSTALLED AT EVERY SEVEN FOOT CHANGE IN ELEVATION OF LATERAL LINES. VALVE SIZE TO MATCH PIPE SIZE.

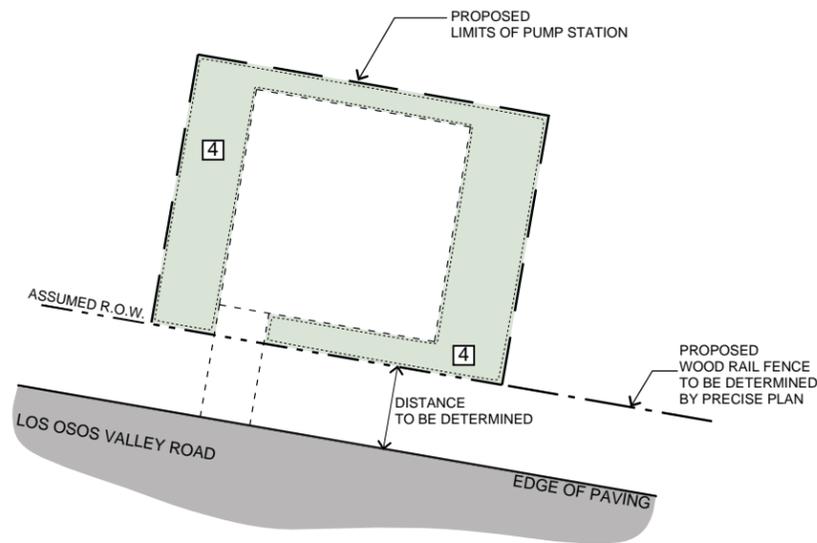
### VALVE CALLOUT SYMBOL



DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.



revision	△	
Owner:	County of San Luis Obispo Department of General Services 1087 Santa Rosa Street San Luis Obispo, California	
Project:	Los Osos Wastewater Project Habitat Management Plan	
Sheet Title:	Sunny Oaks & Solano Pump Stations Irrigation Plan	
Principal: David W. Frote ASLA Registration No. 27120 187 Park Lane, San Luis Obispo CA 93401 805.781.9600 fax 805.781.9603		
<b>firma</b> landscape architecture planning environmental studies ecological restoration		
job no.	21035	
plan check issue date:	5/12/11	
bid set issue date:		
SHEET		
<b>5</b>		
OF SHEETS		



**PLANT LIST - Seed**

BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
<b>DISTURBED UPLAND AREA</b>	
<b>4 Seed Mix 4 - Approx. 0.06 AC</b>	
Achillea millefolium/Yarrow	2.50
Artemisia californica/California Sage	2.75
Baccharis pilularis/Coyote Brush	0.75
Ericameria ericoides/Mock Heather	3.75
Eriogonum parvifolium/Sea-cliff Buckwheat	3.25
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.75
Lotus scoparius/Deerweed	7.50
Lupinus chamissonis/Dune Bush Lupine	3.50
Salvia mellifera/Black Sage	3.00

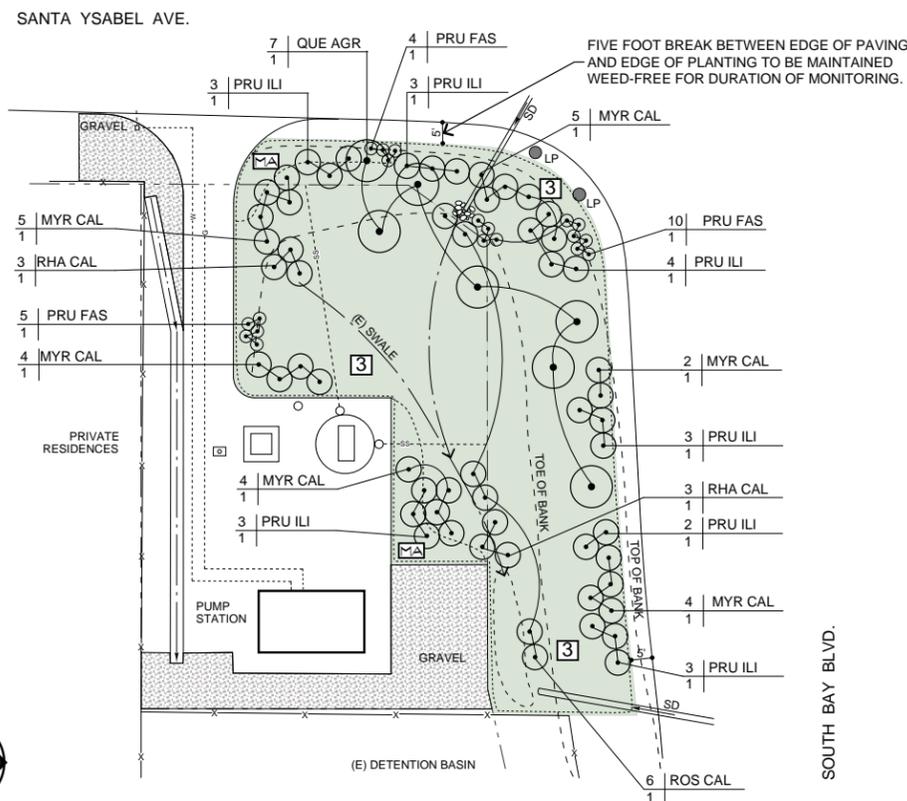
PLS LBS/ACRE = Pure live seed in pounds per acre

THIS PORTION OF THE LOS OSOS WASTEWATER PROJECT IS SCHEMATIC. DIMENSIONS OF FACILITY ARE NOT ESTABLISHED. THIS PLAN IS SUBJECT TO CHANGE. GOAL IS TO PROVIDE A PLANT PALLETTE MATCHING THE SURROUNDING AREA. THIS PLAN SHALL GUIDE AND DIRECT PRODUCTION OF A PRECISE PLAN BY SAN LUIS OBISPO COUNTY TO INSURE COMPLIANCE WITH THE COASTAL COMMISSION CONDITIONS OF APPROVAL.



North

**Mid-Town Pump Station**



**PLANT LIST - Containers**

ABBREV TREES	SPACING	SIZE	BOTANICAL NAME/COMMON NAME	SOURCE
QUE AGR		T	Quercus agrifolia/California Live Oak	Acorns:collected
<b>SHRUBS</b>				
MYR CAL	3'o.c.	T/1G	Mimulus aurantiacus/Bush Monkey Flower	Seed/cutting:collected
PRU FAS	6'o.c.	T/1G	Myrica californica/Pacific Wax-leaf Myrtle	Cutting:collected
PRU ILI	3'o.c.	T/1G	Prunus fasciculata punctata/Sand Almond	Seed/cutting:collected
RHA CAL	6'o.c.	T/1G	Prunus ilicifolia/Hollyleaf Cherry	Seed/cutting:collected
ROS CAL	5'o.c.	T/1G	Rhamnus californica/Coffeeberry	Cutting:collected
	6'o.c.	T/1G	Rosa californica/California Rose	Cutting:collected

T = tree band  
1G = one gallon

**PLANT LIST - Seed**

BOTANICAL NAME / COMMON NAME	PLS LBS / ACRE
<b>3 Seed Mix 3 - Approx. 0.2 AC</b>	
Achillea millefolium/Yarrow	2.00
Artemisia californica/California Sage	0.50
Baccharis pilularis/Coyote Brush	0.05
Ericameria ericoides/Mock Heather	1.50
Eriogonum parvifolium/Sea-cliff Buckwheat	1.50
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.50
Helianthemum scoparium/Rushrose	0.50*
Isocoma menziesii/Coast Goldenbush	2.00
Lotus scoparius/Deerweed	3.00
Lupinus chamissonis/Dune Bush Lupine	2.50
Mimulus aurantiacus/Bush Monkey Flower	0.02*
Salvia mellifera/Black Sage	2.00

PLS LBS/ACRE = Pure live seed in pounds per acre

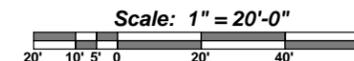
NOTES:  
1. PLACE JUTE MESH ON ENTIRE SLOPE FOLLOWING SEEDING AND PRIOR TO PLANTING, PER SPECIFICATIONS AND MANUFACTURER'S INSTRUCTIONS.



North

**Santa Ysabel Pump Station**

DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.



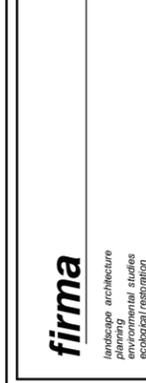
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Owner:  
County of San Luis Obispo  
Department of General Services  
1087 Santa Rosa Street  
San Luis Obispo, California

Project:  
Los Osos Wastewater Project  
Habitat Management Plan

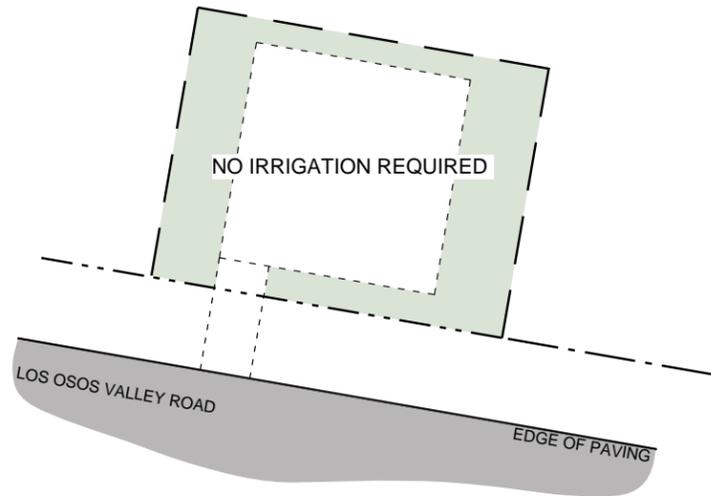
Sheet Title:  
Mid-Town & Santa Ysabel  
Pump Stations  
Planting Plan

Principal: David W. Foote ASLA  
Registration No. 27107  
187 Park Street  
San Luis Obispo CA 93401  
805.781.9600 fax 805.781.9603



job no.	21035
plan check issue date:	5/12/11
bid set issue date:	

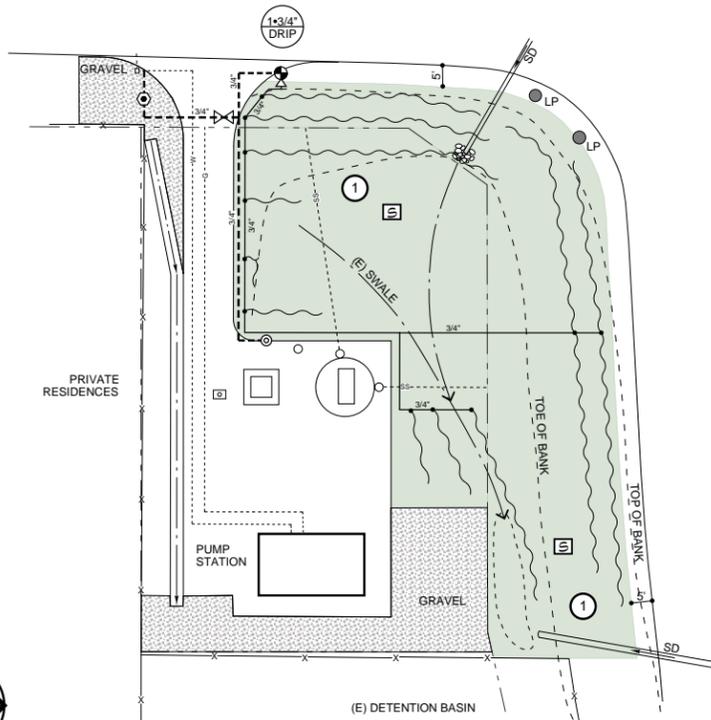
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OF SHEETS



North

Mid-Town Pump Station

SANTA YSABEL AVE.



North

Santa Ysabel Pump Station

Irrigation Schedule

SYMBOL	DESCRIPTION	MODEL	NOTES
	CONTROLLER	IRRITROL IBOC 100 with BAT10 battery	Dtl. 10,L-8
	R.P. BACKFLOW	WILKINS 975XL - 3/4"	Dtl.11,L-8
	ELECTRIC CONTROL VALVE (DRIP)	IRRITROL 700 SERIES ULTRAFLOW, size per plan	Dtl. 10,L-8
	PRESSURE REGULATOR	WILKINS 500YSBR SERIES	Dtl. 20,L-8
	FILTER (DRIP)	AG PRODUCTS #4E, Size to match valve	Dtl. 20,L-8
	QUICK COUPLER VALVE	RAINBIRD 33DRC w/ 33K	Dtl. 22,L-8
	SHUTOFF VALVE	NIBCO T-560 BALL VALVE	Dtl. 23,L-8
	FLUSH VALVE	AG PRODUCTS 3/4-B BALL VALVE	Dtl. 21,L-8
	CHECK VALVE	KBI CV-SIZE PER PIPE, AS NEEDED (SEE NOTES)	
	PRESSURE LINE	SCHEDULE 40 PVC, 18" Deep	Dtl. 912,L-8
	DRIP PVC LATERAL	CLASS 200 PVC w/ DRIP TUBE ADAPTOR	Dtl. 30-33,L-8
	DRIP ZONE	RAINBIRD XBS POLYETHYLENE HOSE .615" I.D.	Dtl. 30-33,L-8
	PVC SLEEVE	PVC SCH 40, 2x LINE SIZE	

EMITTER SCHEDULE

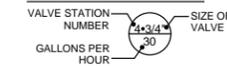
Plant Size	Emitter	Number Per Plant
1 G	1 GPH EMITTER	2
5 G	2 GPH EMITTER	2
15G	1 GPH EMITTER	4

- SLEEVE UNDER ALL PAVING PER SPECIFICATIONS.
- LATERAL & MAINLINE LOCATIONS ARE SCHEMATIC. LOCATE PIPING IN PLANTER ADJACENT TO PAVING EDGE.
- KING BROTHERS IN-LINE CHECK VALVE SHALL BE INSTALLED AT EVERY SEVEN FOOT CHANGE IN ELEVATION OF LATERAL LINES. VALVE SIZE TO MATCH PIPE SIZE.

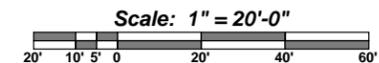
NOTES:

- SEEDING SHALL OCCUR PRIOR TO RAINY SEASON, USING SEASONAL PRECIPITATION TO GERMINATE AND ESTABLISH PLANTS

VALVE CALLOUT SYMBOL



DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.



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Owner:  
County of San Luis Obispo  
Department of General Services  
1087 Santa Rosa Street  
San Luis Obispo, California

Project:  
Los Osos Wastewater Project  
Habitat Management Plan

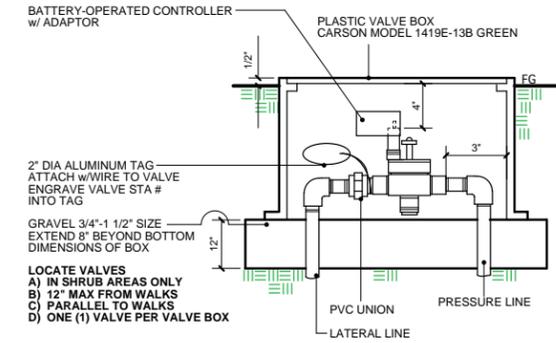
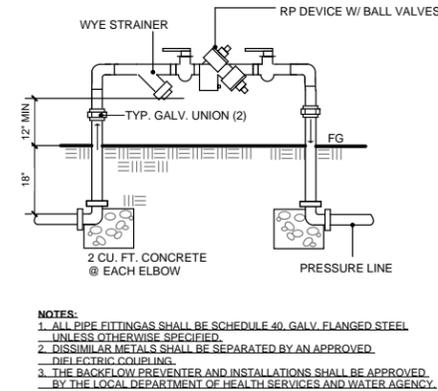
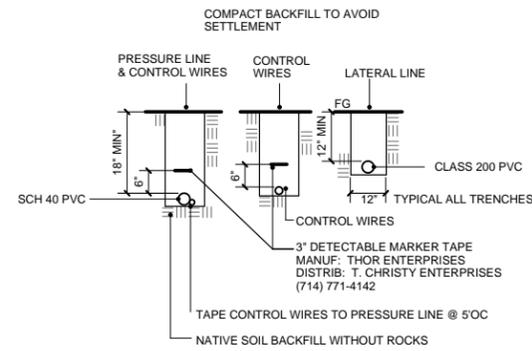
Sheet Title:  
Mid-Town & Santa Ysabel  
Pump Stations  
Irrigation Plan

Principal: David W. Foote ASLA  
Registration No. 2117  
197 Park Lane, San Luis Obispo CA 93401  
805.781.9600 fax 805.781.9603



job no.	21035
plan check issue date:	5/12/11
bid set issue date:	

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OF SHEETS

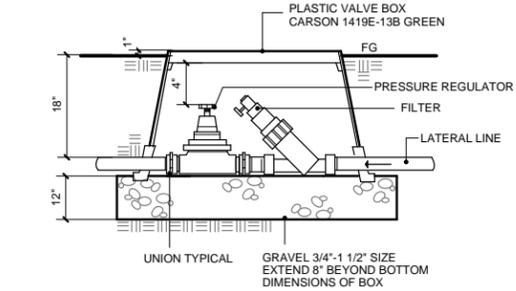
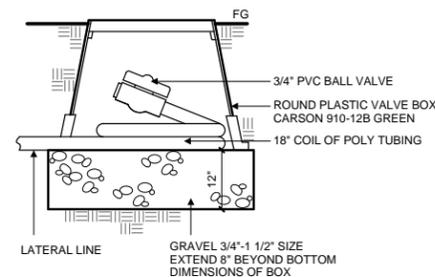
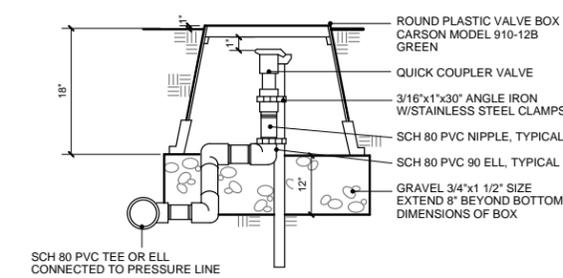
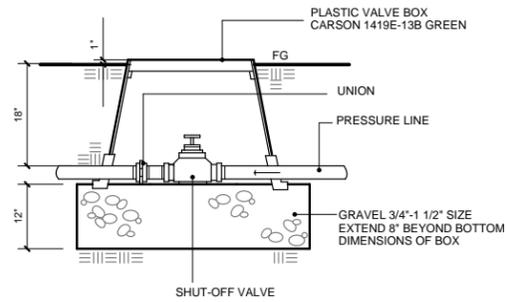


13

12 TRENCHING

11 REDUCED PRESSURE BACKFLOW DEVICE

10 ELECTRIC CONTROL VALVE with CONTROLLER

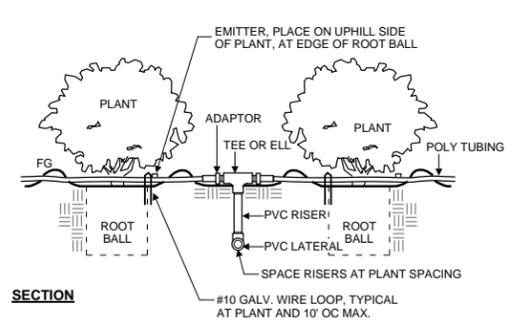
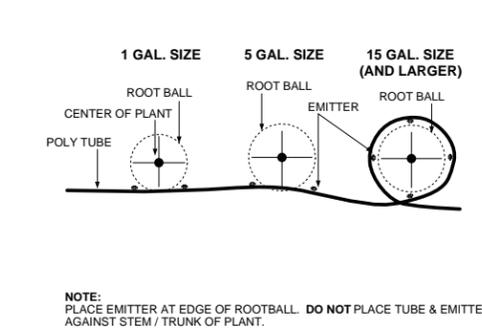
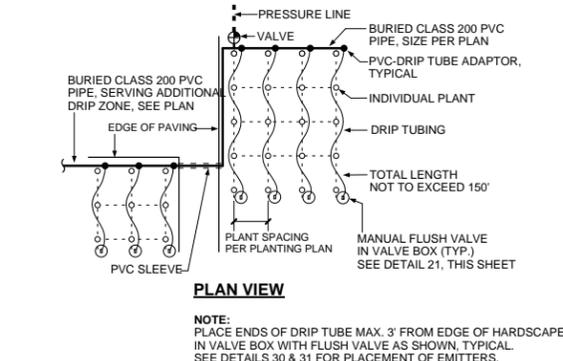
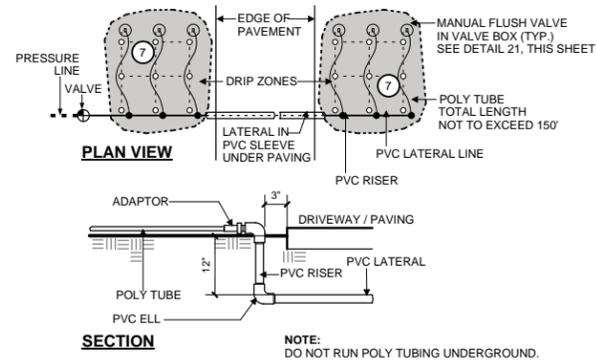


23 SHUT-OFF VALVE

22 QUICK COUPLER VALVE

21 FLUSH VALVE - DRIP

20 FILTER AND PRESSURE REGULATOR - DRIP

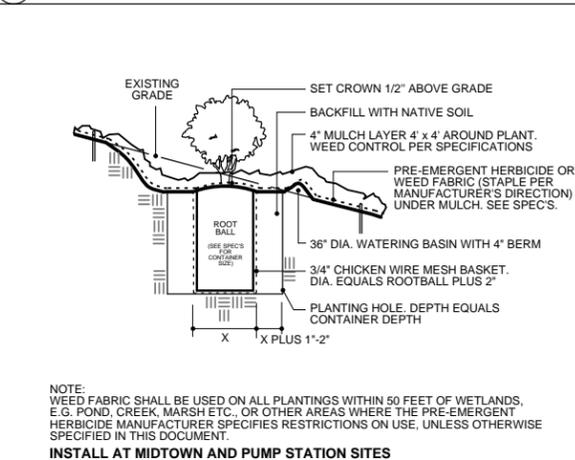
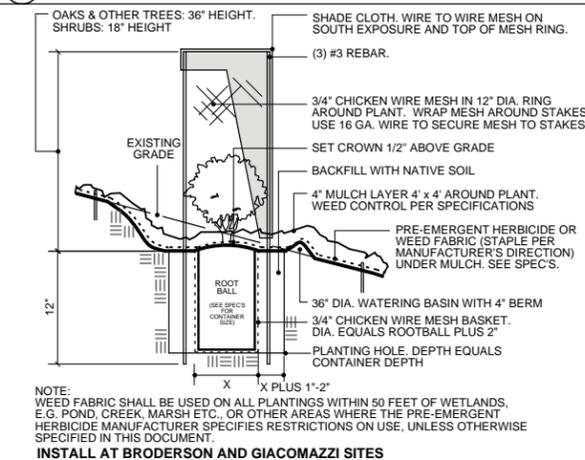


33 DRIP ZONE SCHEMATIC

32 DRIP TUBING LAYOUT SCHEMATIC

31 DRIP EMITTER PLACEMENT

31 DRIP RISER & TUBING SCHEMATIC



43

42 TREE, & SHRUB PLANTING WITH ENCLOSURE

41 TREE & SHRUB PLANTING

40

DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.



revision

County of San Luis Obispo  
Department of General Services  
1087 Santa Rosa Street  
San Luis Obispo, California

Project:  
Los Osos Wastewater Project  
Habitat Management Plan

Sheet Title:  
Planting & Irrigation Details

Principal: David W. Foote ASLA  
Registration No. 2117  
1087 Santa Rosa Street  
San Luis Obispo CA 93407  
805.781.9600 fax 805.781.9603

**firma**  
landscape architecture  
planning  
environmental studies  
ecological restoration

job no. 21035  
plan check issue date: 5/12/11  
bid set issue date:

SHEET  
8  
OF SHEETS

**Planting Specifications**

- Scope of work: All labor materials tools and the transportation and performance of all the work required as indicated on the drawings and specifications and reasonable incidental to:
  - Furnish all contract grown plant material & seed.
  - Eradication of exotic species
  - Protection of existing vegetation to be undisturbed
  - Planting trees and shrubs.
  - Seeding via seed drilling or hydroseeding.
  - Erosion control netting.
  - Weed control.
  - Mulch placement.
  - Clean up
  - Establishment period
- Implementation:** The project will be implemented by a qualified restoration contractor. Contractor shall work in coordination with a County-appointed qualified biologist or restoration specialist (Project Biologist) for entirety of project.
- Verification of job conditions:** Contractor shall verify actual job conditions and report any discrepancies between the plans and actual conditions immediately to the County (County of San Luis Obispo), refraining from doing any work in said areas until given approval to do so.
- Acorn collection:** Acorns will be collected in the fall from Coast Live Oak trees in the Los Osos region. Viability of acorns shall be determined per the Habitat Mangement Plan, and only viable acorns shall be planted. Acorns shall be planted in fall on site or in containers per plans, specifications and details.
- Plant propagation:** To the maximum extent feasible propagate all plant material from locally collected seed and vegetative propagules that are appropriate to the habitats and the Los Osos region. All container plants shall be well rooted #1 size containers or tree bands as noted on plant list.
- Exotic Species Eradication:** Prior to the start of construction, all invasive, non-native species shall be identified on each site by the Project Biologist. The most effective method of removal for each species shall be determined and an eradication plan provided by the contractor for the Project Biologist to review. Upon approval from the Project Biologist and the County the Contractor shall implement the eradication plan. Complete die-off is required prior to removal and disposal off site. Planting and seeding shall not occur until Project Biologist verifies complete removal of exotic plants. All herbicide application shall be done by a licensed pesticide operator. All necessary permits shall be the responsibility of the Contractor. All work shall be done in accordance with local and state laws regulating the use of herbicides.
- Erosion Control Netting** for graded areas identified on plan:
  - RECP Netting (Jute Mesh) Type 'B', weight shall be 20.6 ounces per square yard with open area of 50%. RECP Netting shall be composed completely of woven coir with tensile strength of 125 pounds per foot under ASTM D5035.
  - Fasteners shall be 9 gauge 6" U-shaped staples with 6" legs and 1" crown.
  - RECP Netting shall be rolled from top to bottom of slope secured by fasteners following manufacturer's directions. Netting shall have a minimum 3" overlap with adjacent lengths. Place on slopes of 3:1 or steeper.
- Vegetation Protection:** The Contractor shall preserve and protect all vegetation and trees not designated to be removed in areas where grading and construction are immediately adjacent. Vegetation shall be protected by a 48" orange plastic fencing staked every 10', placed at the dripline. Fencing locations shall be discussed with the Project Biologist prior to installation.

- Planting procedures for container-grown plants:** The Contractor shall excavate planting holes at least 24" diameter. Depth of hole shall be per planting detail. Use only native soil backfill. Do not fertilize. Crowns must be set slightly above the surrounding grade. Space plants as directed by the plans or by the Project Biologist. Completely fill the plant basin with water before mulching and allow to percolate. Fill again with water, percolate, apply weed barrier fabric or pre-emergent herbicide and mulch per note #11 below. Irrigate again in 2 weeks. Provide deep watering at wide intervals to encourage deep rooting, e.g. 30 to 60 days. Do not overwater.
- Pre-emergent Herbicide:** Apply an appropriate pre-emergent herbicide, according to manufacturer's directions, in mulched area around all container plants unless weed barrier is required, as shown on the planting details. Any plant materials showing loss of vigor or health due to improper application of herbicide shall be replaced by the Contractor.
- Mulch** with 4" layer of wood chip mulch extending beyond basin such that a 48" diameter area is mulched at each plant. Mulch should be shredded and composted bark and / or recycled wood product, consisting principally of wood chips and low in composted green waste fines, free from weeds and soil, plastic, metal, and paper debris, and certified free from levels of chlorine, salts or boron in levels that are harmful to plants, **OR, chipped material stockpiled at Broderson site may be used at the direction of the Project Biologist.** Place mulch in 4 inch minimum layer in all container plant basins and where designated in planting areas. Mulch made from chemically-treated wood (including fertilizers) is not acceptable. Mulch containing walnut, hay, straw, almond hulls or seaweed is also not acceptable.
- Inspection notice:** The Contractor must give 48 hour prior notice to the County when materials or work are ready to be inspected.
- Grade:** Quality and size shall conform to the State of California Grading Code of Nursery Stock, No. 1 grade. Contract grown stock only shall be used.
- Inspection and substitutions:** Plants shall be the species and sizes shown on the plan. No ornamental varieties or cultivars shall be used. No species substitutions will be used without the written approval of the Project Biologist. The Project Biologist shall inspect and approve or reject plant material prior to installation.
- Shrub and tree planting:** Per details on plans and Note #9 above. Notify the County if any obstructions, bedrock or hardpan conditions are encountered.
- Grass plug planting:** Native soil shall be smooth and loose prior to plugging. Make a single deep cut through surface roots on each side and bottom of plug. Drill 1" diameter holes 12" on center slightly less than the depth of plug. Step on planted plug insuring firm contact with soil, water immediately.
- Hydroseeding:** The Project Biologist must be present to inspect the amounts of materials being mixed and applied and shall reject any materials or work not conforming to the specifications. Mixing time of materials shall not exceed 45 minutes from the time the seed contacts the water until the entire batch is discharged onto the earth.
  - Repair slopes and Under Jute Mesh: Prepare Batch 1 of slurry using wood fiber mulch at 1000 pounds per acre with seed and water in proportions specified on the plans or herein. Apply this mix to areas designated on plans. Prepare Batch 2 of slurry using wood fiber mulch at 1000 pounds per acre and tackifier at 80 pounds per acre with no seed and water in proportions specified on the plans or herein. Apply this mix over Batch 1.

- All other areas identified on plans: Prepare slurry using wood fiber mulch at 2000 pounds per acre with seed and water in proportions specified on the plans or herein.
- Drill Seeding:**
  - Equipment: Seeding equipment must be a rangeland drill seeder with a ring roller attached. The seeder must be equipped with a fluffy seed box with agitators to prevent bridging and clogging. The seed box must have metal row dividers and individual box adjustment to meter seed flow.
  - Construction: Drill Seed must be applied as follows:
    - Drill seed in rows at a maximum distance of 8 inches apart. Drill seed to a depth of 1 inch.
    - A minimum of 3 passes in different directions with seeding equipment is required to distribute the seed and reduce uniform row appearance.
- Commencement of establishment period:** The establishment period shall begin after all work has been satisfactorily completed and granted final completion notice by the County. The establishment period shall be 12 months. See Performance and Establishment Specifications as well as Habitat Management Plan Report for tasks, and criteria for plant survival and plant health.

**Irrigation Specifications**

- Scope of Work:** All labor, materials, tools and the transportation and performance of all the work required as indicated on the drawings and specifications and reasonably incidental to:
  - Connection to water supply.
  - Backflow device and gate valves.
  - Irrigation mains, laterals and couplings.
  - Automatic controllers, electric control valves and wiring.
  - Quick coupler valves.
  - Drip irrigation.
  - All related trenching and backfilling.
- County of San Luis Obispo shall provide supply of water via a water truck or point of connection from wastewater facilities to establish all container plants.
- Inspection:** Contractor shall notify the Owner 48 hours in advance when each work phase is ready to be inspected.
- Static Pressure:** Contractor shall check static pressure at the irrigation point of connection to the water supply before beginning work and notify Owner in writing of the pressure available.
- As Built:** Contractor shall provide two copies of an "As-Built" plan of the irrigation system prior to final acceptance of work. Both copies shall be provided to the Owner.
- Guarantee:** All work under this section will be guaranteed for a period of one year from the final approval of work. Any damages caused by the irrigation system shall be the responsibility of the Contractor.

- Piping under paving:** All mains and laterals required under paving shall be in PVC sleeves, on a minimum of 6-inch deep sandy base under pipe, prior to paving. Pipe diameter to be two (2x) times pipe size, minimum.
- Horizontal clearance:** All irrigation lines shall have 12 inches of horizontal clearance from lines of other trades.
- Trench depth:** Pressure line minimum depth to be 18 inches. Under paving pressure line shall be 24-inch minimum depth. Lateral line minimum depth to be 12 inches. Under paving lateral line minimum depth shall be 24 inches.
- Joints:** Plastic to plastic joints shall be solvent-weld using solvent and procedures recommended by the pipe manufacturer.
- Threaded fittings:** Teflon tape or "Rector-Seal" soft set pipe dope shall be used on all threaded fittings.
- Connection of valves:** Connect control wires to valves using Rainbird Model ST-03 wire connectors and PT-S5 sealer or equals. Wire should be installed so that a loop encircles the valve. Provide slack so that it can be cut and reconnected if necessary.
- General:** The Contractor shall not allow nor cause any of his work to be covered or enclosed until it has been inspected and approved by the Owner. Should any of his work be enclosed or covered before such inspection or test, he shall uncover the work at his own expense, and after it has been inspected, tested and approved, shall make all repairs with like materials necessary to restore all his work and that of the other contractors to its original condition.
- Pressure test:** After completion of the piping system and prior to backfilling, the entire system shall be thoroughly flushed under pressure to remove dirt, scale or other material from the lines. The pressure lines shall then be tested at full pressure for 2 hours with couplings exposed and pipe sections center loaded. Provisions shall be made to bleed the lines of air. Should any leaks develop, the system shall be retested following repair. The pressure test must be made in the presence of the Owner.
- Compaction:** After the work has been inspected and approved, backfill all trenches with fine earth materials and tamp to 90 per cent compaction. All trenches shall be left flush with adjoining grade in a firm unyielding condition. Flooding of trenches shall not be permitted
- Drip system: Pressure setting (outflow):** Delivery pressure at the pressure reducing device shall be 30 psi, or to allow normal operation of each emitter on the circuit, per manufacturer's specifications.
- Drip tubing:** Maximum drip tubing lateral lengths may not exceed 300 feet from valve. Do not run continuous, winding tube laterals. Lay tubing in parallel lines approximately 5 feet apart, depending on plant spacing, and meander among plants.
- Remove all excess materials** and other debris from the site. Sweep all paved areas of soil, leaves and other material. Rake clean all landscaped areas.

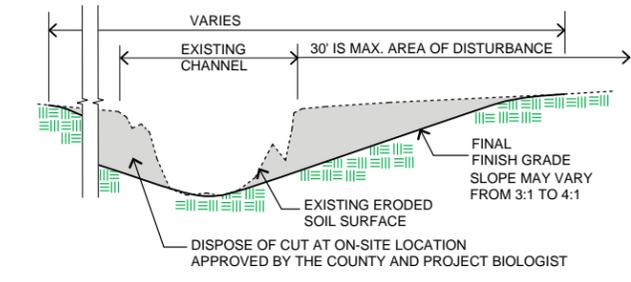
**Performance and Establishment Specifications**

- Coastal Development Permit Conditions of Approval:** Contractors shall comply with plans, details and specifications to meet requirements of C.O.A. #3 'Habitat Management Plan' (HMP), (c) 'Planting and Invasive /Non-Native Plant Provisions: Except that the mature eucalyptus trees, and the mature cypress trees on the Broderson site shall remain and be managed as part of the HMP, all invasive and/or non-native plant species shall be removed from all restoration and enhancement areas, and native species of local stock appropriate to the habitats and the Los Osos area shall be planted. Seed and/or vegetative propagules shall be obtained from local natural habitats so as to protect the genetic makeup of natural populations.
- Performance Standards**  
The restored area will be maintained and managed to meet the following criteria (minimum performance standards):
  - For set out plants, 75% survival at the end of three years, 100% mortality of up to three species within the parameter of 75% survival of total plants is acceptable.
  - For seeded area, minimum 40% cover composition of native grasses and herbaceous plants at the end of three years.
  - Health and vigor: Adequate
  - Exotic species: No more than 5% cover
  - Erosion: Not apparent or minimal

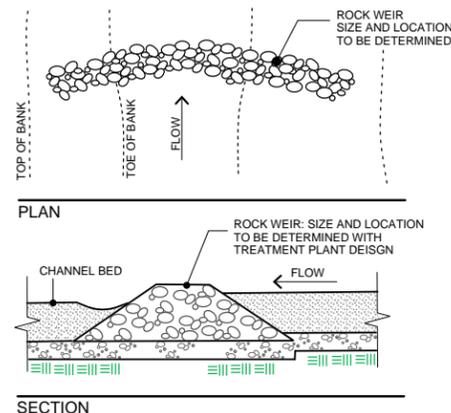
If an area fails to meet the above stated revegetation standards, corrective actions will be identified in the annual report and enacted by the County prior to the start of field surveys for the next annual report. The determination of the success of the restoration objectives shall be made by the consulting restoration specialist in consultation with the Coastal Commission.
- Maintenance:** Maintenance refers to those activities necessary to ensure that the project objectives are achieved, including: 1) regular removal of invasive, exotic plants before seed is set; 2) revegetation of areas where damage has occurred or plant cover deficiencies are identified, and; 3) prevention of damage to plants from herbivores and human activities.

During the 12 month establishment/maintenance period the contractor shall 1) apply irrigation as appropriate for prevailing weather conditions and maintain the irrigation system in good repair; 2) perform weed control to guarantee less than 10% non-indigenous plant species; 3) provide re-seeding and/or containers plants installed in a timely manner at the optimal season to guarantee a minimum of 40% of perennial native species in good health and vigor.

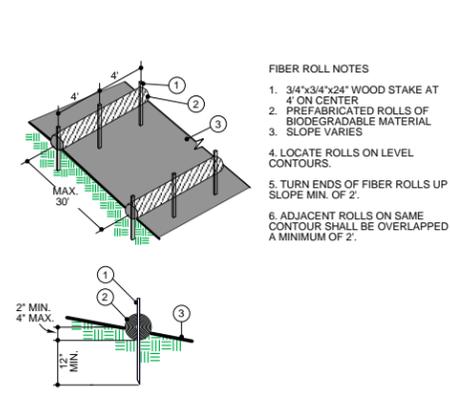
DIRECTIVES AND STANDARDS FROM THE HABITAT MANAGEMENT PLAN REPORT, SECTIONS 4, 5, 6 & 7 APPLY TO THESE DRAWINGS.



42 GRADE CONTROL FOR DRAINAGE CHANNEL - GIACOMAZZI AREA 2



41 FIBER ROLLS - SKETCH



40

revision	△
Owner:	County of San Luis Obispo Department of General Services 1087 Santa Rosa Street San Luis Obispo, California
Project:	Los Osos Wastewater Project Habitat Management Plan
Sheet Title:	Technical Specifications Erosion Control Details
Principal: David W. Fofe ASLA Registration No. 27170 107 York San Luis Obispo CA 93401 805.781.9600 fax 805.781.9603	
<b>firma</b> landscape architecture planning environmental studies ecological restoration	
job no. 21035	
plan check issue date: 5/12/11	
bid set issue date:	
REGISTERED LANDSCAPE ARCHITECT DAVID W. FOFE NO. 2117 Expiration Date: 3-31-12 Date: _____ STATE OF CALIFORNIA	
SHEET	9
OF SHEETS	

43 SCHEMATIC REPAIR OF CHANNEL - GIACOMAZZI AREA 2

**APPENDIX B:  
Container Plant and Seed Lists**



**GIACOMAZZI TREATMENT PLANT SITE**

Channel Bank Erosion Repair Areas

Total Plants: 870

Container Plant List

Artemisia californica/California Sage  
Artemisia douglasiana/Mugwort  
Baccharis pilularis/Coyote Brush  
Rubus ursinus/California Blackberry  
Salvia mellifera/Black Sage

**SUNNY OAKS**

Facility Screening

Total Plants: 48

Container Plant List

Baccharis pilularis/Coyote Brush  
Mimulus aurantiacus/Bush Monkey Flower  
Myrica californica/Pacific Wax-leaf Myrtle  
Prunus ilicifolia/Hollyleaf Cherry  
Rhamnus californica/Coffeeberry  
Rosa californica/California Rose

**MID-TOWN SITE**

Percolation Basin and Swale

Total Plants: 1,236

Container Plants

Artemisia douglasiana/Mugwort  
Carex praegracilis/Field Sedge  
Prunus fasciculata punctata/Sand Almond  
Rosa californica/California Rose  
Rhamnus californica/Coffeeberry

**BRODERSON**

Leach Field

Total Plants: 1,500

Container Plants

Artemisia californica/California Sage  
Baccharis pilularis/Coyote Brush  
Ceanothus cuneatus var. cuneatus/Buckbrush  
Lupinus chamissonis/Dune Bush Lupine  
Salvia mellifera/Black Sage

**SOLANO**

Pump Station

Total Plants:38

Container Plant List

Mimulus aurantiacus/Bush Monkey Flower  
Myrica californica/Pacific Wax-leaf Myrtle  
Prunus ilicifolia/Hollyleaf Cherry  
Rhamnus californica/Coffeeberry  
Rosa californica/California Rose

**EAST YSABEL**

Pump Station

Total Plants:111

Container Plant List

Mimulus aurantiacus/Bush Monkey Flower  
Myrica californica/Pacific Wax-leaf Myrtle  
Prunus ilicifolia/Hollyleaf Cherry  
Quercus agrifolia/Coast Live Oak  
Rhamnus californica/Coffeeberry  
Rosa californica/California Rose

**TOTAL CONTAINER PLANTS SPECIFIED**

**3,803**

**GIACOMAZZI SITE**

<u>Seed Mix 1 (Coastal Scrub/Grasses, 6 acres)</u>	<u>PLS Lbs/Acre</u>
Artemisia californica/California Sage	2.00
Baccharis pilularis/Coyote Brush	1.00
Bromus carinatus/California Brome	1.00*
Leymus condensatus/Giant Rye	1.00*
Lotus scoparius/Deerweed	3.00
Mimulus aurantiacus/Bush Monkey Flower	0.01*
Nassella pulchra/Purple Needlegrass	1.00*
Salvia mellifera/Black Sage	2.00

\*or as much as can be feasibly obtained within the approved collection area

<u>Seed Mix 2 (Coastal Scrub/Riparian repair areas, 2.5 acres)</u>	<u>PLS Lbs/Acre</u>
Artemisia californica/California Sage	2.00
Artemisia douglasiana/Mugwort	2.50
Baccharis pilularis/Coyote Brush	0.50
Distichlis spicata/Saltgrass	0.25*
Leymus condensatus/Giant Rye	1.00*
Leymus triticoides/Beardless Wildrye	1.00*
Lotus scoparius/Deerweed	3.00
Mimulus aurantiacus/Bush Monkey Flower	0.02*
Salvia mellifera/Black Sage	2.00

\*or as much as can be feasibly obtained within the approved collection area

**BRODERSON/SOLANO/EAST YSABEL SITES**

<u>Seed Mix 3 (Coastal Dune Scrub/Maritime Chaparral, 10.5 acres)</u>	<u>PLS Lbs/Acre</u>
Achillea millefolium/Yarrow	2.00
Artemisia californica/California Sage	0.50
Baccharis pilularis/Coyote Brush	0.05
Ericameria ericoides/Mock Heather	1.50
Eriogonum parvifolium/Sea-cliff Buckwheat	1.50
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.50
Helianthemum scoparium/Rushrose	0.50*
Isocoma menziesii/Coast Goldenbush	2.00
Lotus scoparius/Deerweed	3.00
Lupinus chamissonis/Dune Bush Lupine	2.50
Mimulus aurantiacus/Bush Monkey Flower	0.02*
Salvia mellifera/Black Sage	2.00

\*or as much as can be feasibly obtained within the approved collection area

**MID-TOWN SITE**

<u>Seed Mix 4 (Coastal Dune Scrub Upland Areas, 4.8 acres)</u>	<u>PLS Lbs/Acre</u>
Achillea millefolium/Yarrow	2.50
Artemisia californica/California Sage	2.75
Baccharis pilularis/Coyote Brush	0.75
Ericameria ericoides/Mock Heather	3.75
Eriogonum parvifolium/Sea-cliff Buckwheat	3.25
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.75
Lotus scoparius/Deerweed	7.50
Lupinus chamissonis/Dune Bush Lupine	3.50
Salvia mellifera/Black Sage	3.00

<u>Seed Mix 5 (Coastal Dune Scrub Percolation Basin &amp; Swale, 3.1 acres)</u>	<u>PLS Lbs/Acre</u>
Artemisia douglasiana/Mugwort	3.50
Baccharis pilularis/Coyote Brush	0.75
Eriophyllum staechadifolium/Coastal Golden Yarrow	1.75
Isocoma menziesii/Coast Goldenbush	4.25
Lotus scoparius/Deerweed	7.50

**TOTAL NATIVE SEED REQUIREMENT (approx)**

**471 lbs**

**APPENDIX C:  
Monitoring Methods and Forms**



## D. Daubenmire Method

1. *General Description* The Daubenmire method consists of systematically placing a 20- x 50-cm quadrat frame along a tape on permanently located transects (see Figure 4 on page 13). The following vegetation attributes are monitored using the Daubenmire method:

- Canopy cover
- Frequency
- Composition by canopy cover

It is important to establish a photo plot (see Section V.A) and take both close-up and general view photographs. This allows the portrayal of resource values and conditions and furnishes visual evidence of vegetation and soil changes over time.

2. *Areas of Use* This method is applicable to a wide, variety of vegetation types as long as the plants do not exceed waist height.

3. *Advantages and Limitations* This method is relatively simple and rapid to use. A limitation is that there can be large changes in canopy cover of herbaceous species between years because of climatic conditions, with no relationship to the effects of management. In general, quadrats are not recommended for estimating cover (Floyd and Anderson 1987; Kennedy and Addison 1987). This method cannot be used to calculate rooted frequency.

4. *Equipment* The following equipment is needed (see also the equipment listed in Section V.A, page 31, for the establishment of the photo plot):

- Study Location and Documentation Data form Appendix A)
- Daubenmire forms (see Illustration 9 and 10)
- Hammer
- Permanent yellow or orange spray paint
- Two stakes: 3/4 - or 1-inch angle iron not less than 16 inches long
- Tape: 100- or 200-foot, delineated in tenths and hundreds, or a metric tape of the desired length.
- Steel pins (reinforcement bar) for marking zero, mid, and end points of the transect
- Frame to delineate the 20- x 50-cm quadrats (see Illustration 11)
- Compass
- Steel post and driver

5. *Training* The accuracy of data depends on the training and ability of the examiners. Examiners must be able to identify the plant species. They must receive adequate and consistent training in laying out transects and making canopy coverage estimates using the frame.

6. *Establishing Studies* Careful establishment of studies is a critical element in obtaining meaningful data (see Section III).

- a Site Selection** The most important factor in obtaining usable data is selecting representative areas (critical or key areas) in which to run the study (see Section II.D). Study sites should be located within a single plant community within a

single ecological site. Transects and sampling points need to be randomly located within the critical or key areas (see Section III).

**b Pilot Studies** Collect data on several pilot studies to determine the number of samples (transects or observation points) and the number and size of quadrats needed to collect a statistically valid sample (see Section III.B.8).

**c Number of Studies** Establish a minimum of one study on each study site; establish more if needed (see Section II.D and III.B).

**d Study Layout** Data can be collected using the baseline, macroplot, or linear study designs described in Section III.A.2 beginning on page 8. The linear technique is the one most often used.

(1) Align a tape (100-, or 200-foot, or metric equivalent) in a straight line by stretching it between the transect location and the transect bearing stakes. Do not allow vegetation to deflect the alignment of the tape. A spring and pulley may be useful to maintain a straight line. The tape should be aligned as close to the ground as possible.

(2) Drive steel pins almost to the ground surface at the zero point on the tape and at the end of the transect. A pin may also be driven into the ground at the midpoint of the transect. (see Figure 4 on page 13)

**e Reference Post or Point** Permanently mark the location of each study with a reference post and a study location stake (see beginning of Section III).

**f Study Identification** Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground (See Appendix B).

**g Study Documentation** Document pertinent information concerning the study on the Study Location and Documentation Data form (see beginning of Section III and Appendix A).

7. *Taking Photographs* The directions for establishing photo plots and for taking close-up and general view photographs are given in Section V.A.

8. *Sampling Process* In addition to collecting the specific studies data, general observations should be made of the study sites (see Section II.F).

**a Cover Classes** This method uses six separate cover classes (Daubenmire 1959). The cover classes are:

Cover Class	Range of Coverage	Midpoint of Range
1	0 - 5%	2.5%
2	5 - 25%	15.0%
3	25 - 50%	37.5%
4	50 - 75%	62.5%
5	75 - 95%	85.0%
6	95 - 100%	97.5%

- b Ten Cover Classes** Where narrower and more numerous classes are preferred, a ten-cover class system can be used.
- c Collecting Cover Data** As the quadrat frame is placed along the tape at the specified intervals, estimate the canopy coverage of each plant species. Record the data by quadrat, by species, and by cover class on the Daubenmire form (see Illustration 9). Canopy coverage estimates can be made for both perennial and annual plant species.
- (1) Observe the quadrat frame from directly above and estimate the cover class for all individuals of a plant species in the quadrat as a unit. All other kinds of plants are ignored as each plant species is considered separately.
  - (2) Imagine a line drawn about the leaf tips of the undisturbed canopies (ignoring inflorescence) and project these polygonal images onto the ground. This projection is considered “canopy coverage.” Decide which of the classes the canopy coverage of the species falls into and record on the form.
  - (3) Canopies extending over the quadrat are estimated even if the plants are not rooted in the quadrat.
  - (4) Collect the data at a time of maximum growth of the key species.
  - (5) For tiny annuals, it is helpful to estimate the number of individuals that would be required to fill 5% of the frame (the 71- x 71-mm area). A quick estimate of the numbers of individuals in each frame will then provide an estimate as to whether the aggregate coverage falls in Class 1 or 2, etc.
  - (6) Overlapping canopy cover is included in the cover estimates by species; therefore, total cover may exceed 100 percent. Total cover may not reflect actual ground cover.
9. *Calculations* Make the calculations and record the results in the appropriate columns on the Daubenmire form (see Illustrations 9 and 10).
- a Canopy Cover** Calculate the percent canopy cover by species as follows:
- (1) On the Daubenmire form (Illustration 9) count the number of quadrats in each of the six cover class (by species) and record in the Number column on the Daubenmire Summary form (Illustration 10).
  - (2) Multiply this value times the midpoint of the appropriate cover class (Illustration 10).
  - (3) Total the products for all cover classes by species.
  - (4) Divide the sum by the total number of quadrats sampled on the transect.
  - (5) Record the percent cover by species on the form.

- b Frequency** Calculate the percent frequency for each plant species by dividing the number of occurrences of a plant species (the number of quadrats in which a plant species was observed) by the total number of quadrats sampled along the transect. Multiply the resulting value by 100. Record the percent frequency on the form (Illustration 10).
- c Species Composition** With this method, species composition is based on canopy cover of the various species. It is determined by dividing the percent canopy cover of each plant species by the total canopy cover of all plant species. Record the percent composition on the form (Illustration 10).
10. *Data Analysis* Tests should be directed at detecting changes in cover of the species and/or in major ground cover classes. Tests for changes in minor species will have low power to detect change. If quadrats are spaced far enough apart on each transect so as to be considered independent, the quadrat can be analyzed as the sampling unit. Otherwise, the transects should be considered the sampling units. If the transects are treated as the sampling unit, and given that the transects are permanent, either the paired t-test or the nonparametric Wilcoxon signed rank test should be used to test for change between two years. Repeated measures ANOVA can be used to test for differences between 3 or more years. If the quadrats are treated as the sampling units, care must be taken to ensure they are positioned the same along each transect in each year of measurement. A paired t-test, Wilcoxon signed rank test, or ANOVA is then used as described above for transects.

## 11. References

- Daubenmire, Rexford. 1959. A Canopy-coverage method of vegetational analysis. *Northwest Science* 33:43-64.
- 1968. *Plant communities: a textbook of plant synecology*. Harper and Row, New York. 300 p.
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## Daubenmire Summary

Page \_\_\_\_ of \_\_\_\_

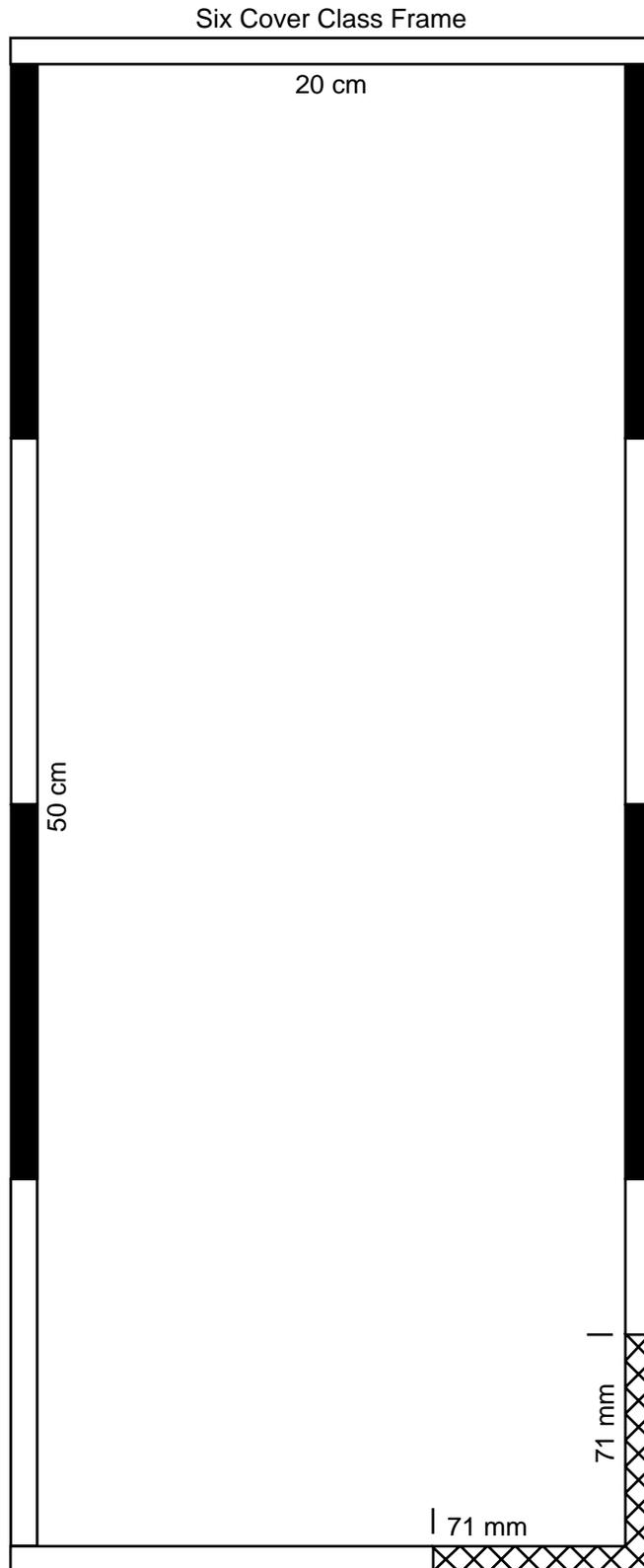
Study Number	Date	Examiner	Allotment Name & Number	Pasture									
Study Location													
Cover Class	Mid-Point	Species		Species		Species		Species		Species		Species	
		Number	Product	Number	Product	Number	Product	Number	Product	Number	Product	Number	Product
1	1-5%	2.5											
2	5-25%	15											
3	26-50%	37.5											
4	51-75%	62.5											
5	76-95%	85											
6	96-100%	97.5											
Total canopy													
Number of Samples													
% canopy cover													
Species composition													
Frequency													

**Daubenmire Summary**

Study Number <i>035-27W-08-02</i>		Date <i>7/24/95</i>	Examiner <i>Chuck Wagon</i>		Allotment Name & Number <i>Quaking Aspen 11037</i>		Pasture <i>Sheep Creek</i>															
Study Location <i>Three miles north of Eagle Tank on the west side of road.</i>																						
Cover Class	Mid-Point	Species <i>PONE</i>		Species <i>ORHY</i>		Species <i>STTH2</i>		Species <i>SIHY</i>		Species <i>BRTE</i>		Species <i>PHHO</i>		Species <i>CRAC2</i>		Species <i>Aster</i>		Species <i>ARTR2</i>		Species <i>CHIV8</i>		
		N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	
1	1-5%	10	25	2	5	3	7.5	2	5	6	15	4	10	3	7.5	3	7.5	1	2.5			
2	5-25%	5	75	3	45	1	15			1	15	2	30		2	30		2	30	2	30	
3	26-50%	2	75	2	75	2	75											2	75	2	125	
4	51-75%	1	62.5	1	37.5	2	75											6	375	2	125	
5	76-95%																			1	85	
6	96-100%																					
Total canopy			237.5		195		97.5		5		30		40		7.5		37.5		482.5		352.5	
Number of Samples			50		50		50		50		50		50		50		50		50		50	
% canopy cover			5		4		2		—		1		1		—		1		10		7	
Species composition			16		13		6		—		3		3		—		3		31		22	
Frequency			36		22		12		4		14		12		6		10		22		16	

## Rangeland Monitoring

### Daubenmire Frame



The frame is made of 3/8-inch iron rod. The inside dimensions of the frame are 20 x 50 centimeters. The frame should have sharpened legs 3 centimeters long welded to each corner to help hold the frame in place.

The six cover class frame is divided into fourths by painting alternate sections of the frame different colors as illustrated. Use orange and white or red and white paint.

In one corner of the frame, delineate two sides of an area 71 millimeters square as illustrated. This area represents 5% of the quadrat area.

The painted design provides visual reference areas equal to 5, 25, 50, 75, 95, and 100% of the plot area.

## E. Line Intercept Method

1. *General Description* The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. The following vegetation attributes are monitored with this method:

- Foliar and basal cover
- Composition (by cover)

It is important to establish a photo plot (see Section V.A) and take both close-up and general view photographs. This allows the portrayal of resource values and conditions and furnishes visual evidence of vegetation and soil changes over time.

2. *Areas of Use* This method is ideally suited for semiarid bunchgrass-shrub vegetation types.

3. *Advantages and Limitations* The Line Intercept method is best suited where the boundaries of plant growth are relatively easy to determine. It can be adapted to sampling varying densities and types of vegetation. It is not well adapted, however, for estimating cover on single-stemmed species, dense grassland situations, litter, or gravel less than 1/2 inch in diameter. It is best suited to estimating cover on shrubs.

4. *Equipment* The following equipment is needed (see also the equipment listed in Section V.A, page 31, for the establishment of the photo plot):

- Study Location and Documentation Data form (see Appendix A)
- Line Intercept form (see Illustration 12)
- Hammer
- Permanent yellow or orange spray paint
- Two stakes: 3/4 - or 1-inch angle iron not less than 16 inches long.
- Two tapes: 100- or 200-foot, delineated in tenths and hundredths, or a metric tape of the desired length
- Compass
- Steel post and driver

5. *Training* A minimum of training is needed to make sure the examiners understand how to lay out baselines and transects and how to make the measurements. The examiner must also be able to identify the plant species.

6. *Establishing Studies* Careful establishment of studies is a critical element in obtaining meaningful data (see Section III).

- a **Site Selection** The most important factor in obtaining usable data is selecting representative areas (critical or key areas) in which to run the study (see Section II.D). Study sites should be located within a single plant community within a single ecological site. Transects and sampling points need to be randomly located within the critical or key areas (see Section III).

- b Pilot Studies** Collect data on several pilot studies to determine the number of samples (transects or observation points) and the number and size of quadrats needed to collect a statistically valid sample (see Section III.B.8).
- c Number of Transects** Establish the minimum number of transects to achieve the desired level of precision for the key species in each study site (see Section III.B).
- d Length of Transect** The length of a transect is based on the density and homogeneity of the vegetation. If the vegetation is sparse, a longer transect is needed. Transects may be any length (eg. 100 feet, 200 feet, or even longer).
- e Study Layout** Line Intercept data can be collected using either the baseline or linear study design described in Section III.A.2 beginning on page 8. The baseline technique is the recommended study design.

- (1) The study location stake is placed at the beginning of the baseline. After determining the bearing of the study, a stake is placed at the end of the baseline. Transects are run perpendicular to and at random distances along the baseline. Transect location stakes are placed at the beginning and end of each transect. The distance between the stakes depends on the length of the transect. The height of the stakes depends on the height of the vegetation. (Directions for randomly selecting the location of transects to be run off of a baseline using random number tables are given in Appendix D).

Transect location stakes may be left in place as permanent markers or removed at the conclusion of the study. Permanently marking transects will result in greater power to detect change.

- (2) Stretch the transect tapes between stakes as close to the ground as possible, with the zero point of the tape aligned on the baseline (the beginning point of the transect). Do not allow vegetation to deflect the alignment of the tape.

- f Reference Post or Point** Permanently mark the location of each study with a reference post and a study location stake (see beginning of Section III).
- g Study Identification** Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (see Appendix B).
- h Study Documentation** Document pertinent information concerning the study on the Study Location and Documentation Data form (see beginning of Section III and Appendix A).

7. *Taking Photographs* The directions for establishing photo plots and for taking close-up and general view photographs are given in Section V.A.

8. *Sampling Process* In addition to collecting the specific studies data, general observations should be made of the study sites (see Section II.F).

Proceed down the tape stretched along the transect line and measure the horizontal linear length of each plant that intercepts the line. Measure grasses and grass-like

plants, along with rosette-forming plants, at ground level. For forbs, shrubs, and trees, measure the vertical projection of the foliar cover intercepting one side of the tape. Be sure not to inadvertently move the tape to include or exclude certain plants. If the measurements are made in 10ths and 100ths of feet, the totals are easily converted to percentages. The measurements are recorded by species on the Line Intercept form (Illustration 12).

9. *Calculations* Make the calculations and record the results on the Line Intercept form (see Illustration 12).

**a Cover**

- (1) Calculate the percent cover of each plant species by totaling the intercept measurements for all individuals of that species along the transect line and convert this total to a percent.
- (2) Where the measurements are made in 10ths and 100ths of feet along a 100-foot transect, the totals for each species are the cover percentages.
- (3) Calculate the total cover measured on the transect by adding the cover percentages for all the species. This total could exceed 100% if the intercepts of overlapping canopies are recorded.

**b Composition** With this method, species composition is based on the percent cover of each species. Calculate percent composition by dividing the percent cover for each plant species by the total cover for all plant species.

10. *Data Analysis* It is important to realize that each transect is a single sampling unit. For trend analysis permanent sampling units are suggested. If permanent transects are monitored, use the appropriate paired analysis technique. Use either a paired t-test or the nonparametric Wilcoxon signed rank test when testing for change between years. When comparing more than two sampling periods, use repeated measures ANOVA. If the transects are not permanently marked, use the appropriate nonpaired test.

11. *References*

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- Buckner, D.L. 1985. Point-Intercept Sampling in Revegetation Studies: Maximizing Objectivity and Repeatability. Paper presented at American Society for Surface Mining and Reclamation Meeting, Denver, CO. 1985.
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- Canfield, R.H. 1944. Measurement of grazing use by the line intercept Method. *Jour. For.* 42(3):192-194

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- Kinsinger, Floyd E., Richard E. Eckert, and Pat O. Currie. 1960. A comparison of the line-interception, variable-plot, and loop methods as used to measure shrub-crown cover. *J. Range Manage.* 13:17-21.
- USDI, Bureau of Land Management. 1985. Rangeland monitoring - Trend studies TR4400-4.



**Line Intercept**

Study Number	Date		Examiner	Allotment Name & Number		Pasture				
	12N-37W-19-03	10/3/95		Jack Straw	Cow Gulch 2011					
Line Length	Transect Location									
100 feet	3 miles east of Potter's Corral on north side of road.									
NOTES (Use other side or another page, if necessary)	Grass Species			Forb Species		Shrub Species		NOTES		
	BOCU	BOGR2	BOH12	KOCR	SIHP	HYRI	PSORA		GOWR2	CEGR
100 ft. tape	.42	.10	.32	.11	.06	.52	2.04	.55	3.40	.06
	.20	.02	.25	.02	.02	.46	1.32	.22	.13	2.13
	.26	.03	.05	.12	.02	1.47	.59		4.90	.07
	.03	.01	.08	.08	.04	.28	3.30		.72	.02
	.17	.29			.05	.80	.07		.14	
	.26	.24			.26	.05			1.02	
	.22	.14			.04					
	.22	.10			.03					
	.34	.17			.01					
	.32	.12			.19					
	.02	.13			.02					
.02	.14			.35						
.02	.04									
.16	.16									
.18	.05									
.10	.27									
.14	.03									
.06	.46									
.03	.07									
.04	.38									
.10	.12									
.02	.10									
.03	.11									
.02	.03									
.02	.36									
.16	.68									
Totals	3.64	4.63	.62	.33	1.09	3.58	7.32	.77	10.31	2.28
% Cover	4	5	1	0	1	4	7	1	10	2
% Comp	11	14	3	-	3	11	20	3	29	6

## F. Step-Point Method

1. *General Description* The Step-Point Method involves making observations along a transect at specified intervals, using a pin to record cover “hits.” It measures cover for individual species, total cover, and species composition by cover.

It is important to establish a photo plot (see Section V.A) and take both close-up and general view photographs. This allows the portrayal of resource values and conditions and furnishes visual evidence of vegetation and soil changes over time.

2. *Areas of Use* This method is best suited for use with grasses and forbs, as well as low shrubs. The greater the structure to the community, the more difficult it becomes to determine “hits” due to parallax, observer bias, wind, etc. This method is good for an initial overview of an area not yet subjected to intensive monitoring.
3. *Advantages and Limitations* This method is relatively simple and easy to use as long as careful consideration is given to the vegetation type to which it is applied. It is suitable for measuring major characteristics of the ground and vegetation cover of an area. Large areas can easily be sampled, particularly if the cover is reasonably uniform. It is possible to collect a fairly large number of samples within a relatively short time.

A limitation of this method is that there can be extreme variation in the data collected among examiners when sample sizes are small. Tall or armored vegetation reduces the ability to pace in a straight line, and the offset for obstructions described in the procedures adds bias to the data collection by avoiding certain components of the community. Another limitation is that less predominant plant species may not be hit on the transects and therefore do not show up in the study records. The literature contains numerous studies utilizing point intercept procedures that required point densities ranging from 300 to 39,000 in order to adequately sample for minor species. One major consideration in the use of this method is to assure that a sharpened pin is used and that only the point is used to record “hits.” Pins have finite diameters and therefore overestimate cover (Goodall 1952). Another limitation of this method is that statistical analysis of the data is suspect unless two and preferably more transects are run per site (see Section III - Study Design and Analysis).

4. *Equipment* The following equipment is needed (see also the equipment listed in Section V.A, page 31, for the establishment of the photo plot):
  - Study Location and Documentation Data form (see Appendix A)
  - Cover Data form (see Illustration 13)
  - Permanent yellow or orange spray paint
  - Tally counter (optional)
  - One stake: 3/4- or 1-inch angle iron not less than 16 inches long
  - 3-foot long, 3/16th-inch diameter sharpened pin
  - Compass
  - Steel post and driver
5. *Training* A minimum amount of training is needed for this method. Examiners must be able to identify the plant species, be familiar with the ground-level cover

categories, know how to collect canopy or foliar cover data, and know how to collect cover data using a pin and notch in the boot.

6. *Establishing Studies* Careful establishment of studies is a critical element in obtaining meaningful data.
  - a **Site Selection** The most important factor in obtaining usable data is selecting representative areas (critical or key areas) in which to run the study (see Section II.D). Study sites should be located within a single plant community within a single ecological site. Transects and sampling points need to be randomly located within the critical or key areas. (see Section III).
  - b **Pilot Studies** Collect data on several pilot studies to determine the number of samples (transects or observation points) and the number and size of quadrats needed to collect a statistically valid sample (see Section III.B.8).
  - c **Number of Transects** Establish the minimum number of transects to achieve the desired level of precision (see Section III.B).
  - d **Study Layout** Data can be collected using either the baseline or linear study designs described in Section III.A.2 beginning on page 8. The linear technique is the one most often used.
  - e **Reference Post or Point** Permanently mark the location of each study with a reference post and a study location stake (see beginning of Section III).
  - f **Study Identification** Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground (see Appendix B).
  - g **Study Documentation** Document pertinent information concerning the study on the Study Location and Documentation Data form (see beginning of Section III and Appendix A).
7. *Taking Photographs* The directions for establishing photo plots and for taking close-up and general view photographs are given in Section V.A.
8. *Sampling Process* In addition to collecting the specific studies data, general observations should be made of the study sites (see Section II.F).
  - a **Running a Transect** Determine the transect bearing and select a prominent distant landmark such as a peak, rocky point, etc., that can be used as the transect bearing point.
    - (1) Start a transect by randomly selecting a point along the transect bearing and reading the first hit (observation point).
    - (2) Read hits at specified intervals by placing the heel of the boot on the ground with the sole of the boot at a 30-degree angle to the ground. Place the pin into the 3/16th inch wide by 1/8th inch deep notch in the toe of

the boot and vertically lower the pin until it either intersects an herbaceous plant or the ground for the specified number of hits. It is recommended that the interval be a minimum of 5 paces. To lengthen the transect, increase the distance between hits (10 paces, 20 paces, etc.).

- (3) When obstructions such as juniper trees, cholla cactus, or ledge rock, etc., are encountered, sidestep at 90° from the transect line and continue pacing parallel to the transect to avoid the obstructions. Return to the original transect line as soon as possible by sidestepping at 90° in the opposite direction. Continue pacing along the transect bearing. If the obstruction (juniper tree, cholla cactus, or ledge rock) is determined to be a highly important component of the community, this information can be recorded qualitatively on the back of the form.
- (4) In most cases, do not count hits along portions of a transect that have been unnaturally disturbed, such as roads or trails. When such areas are encountered, proceed three paces past the disturbance before resuming the reading of hits along the transect line.

**b Collecting Cover Data** At each observation point, identify the ground level or basal hit with the point of the pin and record the data by dot count tally by category and/or plant species code in the appropriate section of the Cover Data form (see Illustrations 13 and 14). If there is a vegetation canopy layer, lower the pin through the vegetation until a basal or ground level hit is determined. Record the basal or ground level hit and any subsequent vegetation layers that intersect the pin. For vegetation structure above 3-feet (length of pin), a visual observation of plant intercepts above the notch in the boot can be made and recorded as additional canopy or foliar level hits on the data form.

(1) *Ground-level or basal hits*

- (a) Ground-level hits (excluding basal vegetation hits) will fall into four cover categories. They can be redefined and/or additional categories added, depending on the data needed. The four categories are:

L - Litter

B - Bare ground

G - Gravel (particle sizes between 1/12 inch and 10 inches)

S - Stone (greater than 10 inches)

- (b) Record the ground-level hits by dot count tally by ground-level cover category in the Ground-Level Cover section of the form, except where there are ground-level and, basal or canopy cover hit combinations. In this situation, use the Basal and Canopy/Foliar Cover section of the form.
- (c) Basal hits on live vegetation are identified by species (includes mosses and lichens more than 1/16 inch thick). To count as a basal hit on live vegetation, the plant crown at or below a 1-inch height above the ground MUST be intercepted by the pin.

- (d) Enter the appropriate plant species code in the Basal or Ground-Level Column in the Basal and Canopy/Foliar Cover section of the form.
- (e) Enter a dot count tally for each basal hit on a species in the Dot Count Column in the Basal and Canopy/Foliar Cover section of the form when the plant species code is first entered on the form. Enter an additional dot count tally each time there is a basal hit on that species on the transect, except where there are basal and canopy/foliar cover hit combinations.

(2) *Ground-level or basal and canopy/foliar cover hit combinations*

- (a) Identify the ground-level or basal hit, as well as any canopy cover hit(s) below 3 feet in height, intercepted at each point by the pin. For canopy cover above 3 feet, use line-of-sight observations directly perpendicular to the notch in the boot.
- (b) Enter the appropriate ground-level cover category code and/or plant species code for each level of hit (up to four levels) in the appropriate columns in the Basal and Canopy/Foliar Cover section of the form (see Illustration 13).
- (c) Enter a dot count tally for each ground-level or basal and canopy/foliar cover hit combination when it is first entered on the form and each time this same combination is encountered on the transect.
- (d) Enclose plant species codes for vegetation cover hits more than 20 feet above ground level in brackets [ ].

9. *Calculations* Calculate the percent cover for each cover category by dividing the number of hits for each category by the total number of hits for all categories, including hits on vegetation.

- a **Ground Cover** Ground cover is determined by dividing the total number of hits for all categories except bare ground by the total number of hits (including bare ground).
- b **Canopy/Foliar Cover** Canopy/Foliar cover is determined by dividing the total number of hits on vegetation (includes all basal and canopy/foliar hits) by the total number of hits.
- c **Basal Cover** Basal cover is determined by dividing the number of basal hits by the total number of hits.

10. *Data Analysis*

- a When transects are the sampling units: For trend analysis, permanent sampling units are suggested. If permanent transects are monitored, use the appropriate paired analysis technique to compare change in average cover by species and cover class. When comparing more than two sampling periods, use repeated

measures ANOVA. If the transects are not permanently marked, use the appropriate nonpaired test.

- b When points are the sampling units: To determine if the change between sampling periods is significant, use Chi Square analysis of variance for cover data.

## *11. References*

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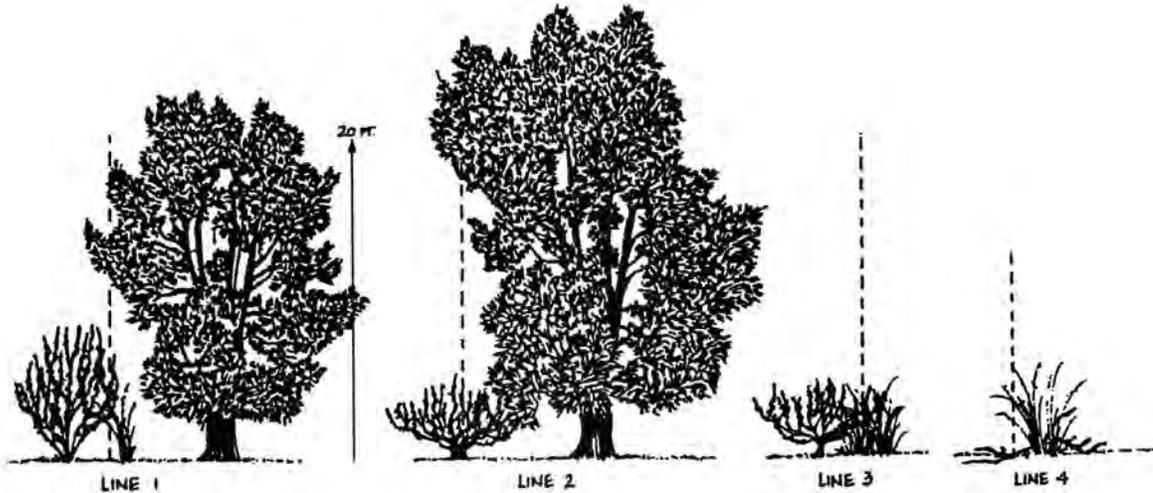
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Diagrammatic Sketches of Sample Units (Hits) and Recording Procedures



The data from the above illustrated sample units (hits) are recorded on the Cover Data Form as follows:

BASAL and FOLIAR				
	BSL or grnd-lev	Foliar-level 1	Foliar-level 2	Foliar-level 3
Line 1 —	<i>B</i>	<i>AGSP</i>	<i>PUTR 2</i>	<i>PIED</i>
Line 2 —	<i>ARTR 2</i>	<i>[PIED]</i>		
Line 3 —	<i>AGSP</i>	<i>CHNA 2</i>		
Line 4 —	<i>L</i>	<i>AGSP</i>		

Note — To count as a basal hit on live vegetation, the plant crown at or below a 1-inch height above the ground must be intercepted by the pin.

— Dead vegetation in the canopy is counted as litter.

— Enclose plant species codes for vegetation cover hits more than 20 feet above ground level in brackets [ ].

**APPENDIX D:  
Weed Species Removal and Management Methods**



**Bermuda buttercup (*Oxalis pes-caprae*)**

Perennial

Reproduce via bulblets and stem runners

Control: Combination of physical removal and herbicide (Glyphosate with surfactant) application before flowering (later winter). First remove top growth and bulblets by sifting soil. Then spray emerging plants with herbicide monthly during growing season (after fall rains through late spring). Monitor site monthly November through May for three years, spraying newly emerging plants.

**Bermuda grass (*Cynodon dactylon*)**

Perennial grass, warm-season

Reproduce via seed and rhizomes

Control: Herbicide (2% solution of Glyphosate) application in Spring and Fall (when plants in full bloom) using a hand sprayer. Monitor site monthly during warm season for one to five years, spot spray and mulch.

**Bristly ox-tongue (*Picris echioides*)**

Annual (winter or summer), at times biennial or perennial

Reproduce via seed

Control: Physical removal including 2" of tap root before flowering in April. Monitor area March through June for 5 years, pulling seedlings.

**Giant reed (*Arundo donax*)**

Perennial grass

Reproduce via rhizomes and plant fragments

Control: Option 1: Herbicide (50 to 75% 'Rodeo') application on cut culms within 5 minutes of cutting in the Fall. Monitor site monthly during growing season for one year, spot spray all new growth. Burn all debris. Option 2: Remove all surface vegetation and roots physically. Monitor site monthly during growing season for one year, spot spray new growth with herbicide (1.5% Glyphosate + 0.5% non-ionic surfactant). Burn all debris.

**Poison hemlock (*Conium maculatum*)**

Biennial, perennial at times

Reproduce via seed

Control: Option 1: Physically remove rosettes and mature plants in April or May, before setting seed. Monitor site for three years in late Spring, pulling seedlings. Option 2: Herbicide (2,4 D ester, 2,4 D amine, or glyphosate plus surfactant) application in late Spring. Monitor site for three years in late Spring spraying or pulling seedlings.

**Ice plant (*Carpobrotus* sp.)**

Succulent Perennial

Reproduce via seed and vegetatively, rooting at any node contacting soil

Control: Option 1: Physically remove all live shoot segments. Monitor site monthly for one year, pulling all resprouts.

Option 2: Herbicide (2% glyphosate with 1% surfactant) application any time of the year. Monitor site monthly for one year, spraying resprouts.

**Italian thistle (*Carduus pycnocephalus*)**

Annual

Reproduce via seed

Control: Option 1: Physical removal of plant and root 4" deep, in mid Spring before seeds set. Monitor every 6 months for up to 10 years, pull seedlings.

Option 2: Herbicide application in mid Spring before seeds set. A variety of herbicides are effective. Monitor every 6 months for up to 10 years, spraying or pulling seedlings.

**Mustard (*Hirschfeldia*, *Brassica*)**

Biennial, perennial at times

Reproduce via seed

Control: Physically remove plants below root crown in mid Spring.

Monitor site every 6 months for up to 5 years, pulling seedlings.

**Sweet fennel (*Foeniculum vulgare*)**

Perennial herb

Reproduce via seed and root crown

Control: Prior to removal cut and bag flower heads to remove seeds from site.

Option 1: Herbicide application in early spring with growth of flowering stems. Use of triclopyr at 6 lbs/100 gallons of water (1 lb. of active ingredient per acre is most effective). Monitor site every 6 months for up to 5 years, spraying or pulling seedlings.

Option 2: Physical removal of plants, including 6" below base of root crown. Removal just prior to seed set, mid Spring is most effective. Monitor site every 6 months for up to 5 years, spray or pull seedlings. Combining options 1 & 2 is most effective for large stands.

**Veldt grass (*Ehrharta calycina*)**

Perennial Grass

Reproduce via seed and occasionally from rhizomes

Control: Application of grass-specific herbicide ( Arrow 2EC is recommended, Fusilade is also effective), with surfactant, when grass is actively growing, after fall rains through May, or to new clump growth following mechanical treatment to reduce dead material (weedwhacker). Follow up applications over several years will be necessary to remove resprouts and seedlings.

**Wild radish (*Raphanus sativus*)**

Annual, perennial at times

Reproduce via seed

Control: Physically remove plants below root crown in mid Spring.

Monitor site every 6 months for up to 5 years, pulling seedlings.

SPECIES	MONITOR TIME	MOST EFFECTIVE SEASON OF REMOVAL	REMOVAL METHOD
Bermuda Buttercup	3 years Nov-May monthly	Late winter	Physical & herbicide
Bermuda Grass	1-5 years May-Sept monthly	Spring or Fall	Herbicide
Bristly Ox-tongue	5 years Mar –June monthly	April	Physical or herbicide
Giant Reed	1 year monthly	Fall	Physical & herbicide
Poison Hemlock	3 years Mar-June monthly	April or May	Physical or herbicide
Ice Plant	1 year monthly	Any time	Physical & herbicide
Italian Thistle	Up to 10 years 6 month intervals	April	Physical or herbicide
Mustard	Up to 5 years 6 month intervals	April	Physical or herbicide
Sweet Fennel	Up to 5 years 6 month intervals	March	Physical & herbicide
Veldt Grass	2 years 5 month intervals	January	Physical & herbicide
Wild Radish	Up to 5 years 6 month intervals	April	Physical & herbicide

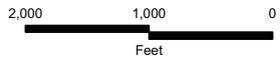
# **Appendix F Archaeological Sensitivity Map**

## **Appendix F Archaeological Sensitivity Map**

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**ARCHEOLOGICAL SENSITIVITY MAP NOT AVAILABLE ON WEBSITE**



**CONFIDENTIAL - For Contract Use Only, Not for Public Distribution**

**Archaeological Sensitivity Map**

LOS OSOS WASTEWATER PROJECT 2012  
Revised: 3/12/2012

# **Appendix G Clean Water State Revolving Funds Laws and Regulations**

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## **CLEAN WATER STATE REVOLVING FUNDS LAWS AND REGULATIONS**

### **Environmental Authorities:**

1. Archeological and Historical Preservation Act of 1974, Pub, L. 86-523, as amended, Pub, L. 93-29116 USC § 469a-1;
2. Clean Air Act, Pub, L. 84-159, as amended;
3. Coastal Barrier Resources Act, Pub, L. 97-~8, 96 Stat. 1653; 16 USC § 3501 et seq.;
4. Coastal Zone Management Act, Pub, L. 92-583, as amended; 16 USC § 1451 et seq.;
5. Endangered Species Act, Pub, L. 93-205, as amended; 16 USC § 1531 et seq.;
6. Environmental Justice, Executive Order 12898;
7. Floodplain Management, Executive Order, 11988 as amended by Executive Order 12148;
8. Protection of Wetlands, Executive Order 11990, as amended by Executive Order No. 12608;
9. Farmland Protection Policy Act, Pub, L. 97-98; 7 USC § 4201 et seq.;
10. Fish and Wildlife Coordination Act, Pub. L. 85-624, as amended;
11. National Historic Preservation Act of 1966, Pub. L. 89-665, as amended, 80 Stat. 917 (1966) 16 USC § 470 et seq.;
12. Safe Drinking Water Act, Pub. L. 93-523, as amended; 42 USC § 300f et seq.;
13. Wild and Scenic Rivers Act, Pub. L. 90-542, as amended, 82 Stat. 913; 16 USC § 1271 et seq.;
14. Essential Fish Habitat Consultation, Pub, L. 94-265, as amended, 16 USC § 1801 et seq.;
15. Recycled Materials, Executive Order 13101; Section 6002 Resource Conservation and Recovery Act - 42 USC § 6962.

### **Economic and Miscellaneous Authorities:**

1. Demonstration Cities and Metropolitan Development Act of 1966, Pub, L. 89-7 54, as amended, Executive Order 12372/42 USC § 3331 et seq.;
2. Procurement Prohibitions under Section 306 of the Clean Air Act and Section 508 of the Clean Water Act, including Executive Order 11738, Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans; 42 USC § 7606; 33 USC § 1368; 40 CFR Part 31;
3. Uniform Relocation and Real Property Acquisition Policies Act, Pub. L. 91-646, as amended; 42 USC §§4601-4655;
4. Contractors, Subcontractors, Debarment and Suspension, Executive Order 12549; 2 CFR Part 180; 2 CFR Part 1532. The Excluded Parties List System can be found at <http://lepls.gov> . The Recipient represents and warrants that it has included a term or conditions requiring compliance with this provision in all of its contracts and subcontracts. The Recipient acknowledges that failing to disclose the information as required at 2 CFR 180.335 may result in the termination, delay or negation of this Agreement;
5. Preservation of Open Competition and Government Neutrality Towards Government Contractors' Labor Relations on Federal and Federally Funded Construction Projects, EO 13202, as amended by EO 13208.;

6. Hotel and Motel Fire Safety Act of 1990 (PL 101-391, as amended). Recipients may search <http://www.usfa.dhs.gov/applications/hotel/>;
7. Records and financial reporting. 40 CFR Part 31;
8. Copyright. 40 CFR Part 31.

**Social Policy Authorities:**

1. Age Discrimination Act of 1975, Pub. L. 94-135; 42 USC § 6102.
2. Race Discrimination. Title VI of the Civil Rights Act of 1964, Pub. L. 88-352.1; 42 USC § 2000d; 40 CFR Part 7.
3. Sex Discrimination. Section 13 of the Federal Water Pollution Control Act Amendments of 1972, Pub. L. 92-500 (the Clean Water Act); 33 USC § 1251 ; 40 CFR Part 7.
4. Disability Discrimination. Section 504 of the Rehabilitation Act of 1973, Pub. L. 93-112 (including Executive Orders 11914 and 11250); 29 USC § 794; 40 CFR Part 7.
5. Equal Employment Opportunity, Executive Order 11246.
6. Women's and Minority Business Enterprise, Executive Orders 11625, 12138, and 12432; 40 CFR Part 31 .
7. Section 129 of the Small Business Administration Reauthorization and Amendment Act of 1988, Pub. L. 100-590.
8. Anti-Lobbying Provisions (40 CFR Part 34). Borrower agrees to submit certification and disclosure forms as requested by the State Water Resources Control Board or the USEPA. In accordance with the Byrd Anti-Lobbying Amendment, any Recipient who makes a prohibited expenditure under 40 CFR Part 34 or fails to file the required certification or lobbying forms shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such expenditure. The Recipient shall ensure that no Project Funds provided by the State Water Board under this assistance agreement are used to engage in lobbying of the federal government or in litigation against the United States unless authorized under existing law, The Recipient shall abide by its respective 2 CFR 200, 225, or 230, which prohibits the use of federal grant funds for litigation against the United States or for lobbying or other political activities.
9. Anti-Litigation Provisions (2 CFR 220, 225, or 230).
10. Trafficking Victims Protection Act of 2000.
11. ACORN Prohibition. None of the Project Funds used in this Agreement may be used for contracts or subcontracts to ACORN.