



**US Army Corps  
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Los Angeles District

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# **Prado Basin Ecosystem Restoration and Water Conservation Study**

## **APPENDIX L Cost Engineering**

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# Cost Engineering Appendix

## Prado Basin Ecosystem Restoration Study

### Prado Dam, CA

**DRAFT**



Prepared: April 2018

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## 1.0 Overview

The study area is Prado Basin located within the Santa Ana River watershed in southern California. The Santa Ana River drainage area upstream of Prado Basin encompasses about 2,650 square miles (686,347 hectares), making it the largest watershed in southern California. The study area is approximately 50 square miles which all surface and groundwater flows from the upstream portions of the Santa Ana River watershed drain into. Four major streams drain into Prado Basin: Chino Creek, Mill Creek, Santa Ana River, and Temescal Creek. Chino Creek channel drains to the western boundary of the study watershed area. Cucamonga and Day Creeks are concrete lined channels traversing the center of the watershed and merging to form Mill Creek before entering Prado Basin. The Santa Ana River is the main watercourse entering Prado Basin from the northeast, and Temescal Creek enters near the southern boundary of the Basin. Flows entering the basin are retained by Prado Dam and released into the Santa Ana River in a controlled manner. Prado Dam is operated by the US Army Corps of Engineers (USACE) and provides flood risk management for downstream urban areas in Orange County.

This study is a multipurpose study that includes ecosystem restoration and water conservation. The objectives of this study include restoring aquatic riverine habitat suitable to native species within the project area and increasing portion of available flow in the Santa Ana River to be managed for water supply.

The study area was divided into four major focuses areas during plan formulation:

### **Santa Ana River (SAR) Upstream**

Includes the area upstream of Prado Dam that encompasses the Prado Basin to elevation 566 feet and the portion of the Santa Ana River from where the river enters Prado Basin to Hamner Avenue.

### **Chino Creek**

From where Chino Creek enters Prado Basin to just upstream of Soquel Canyon Parkway where the creek is channelized.

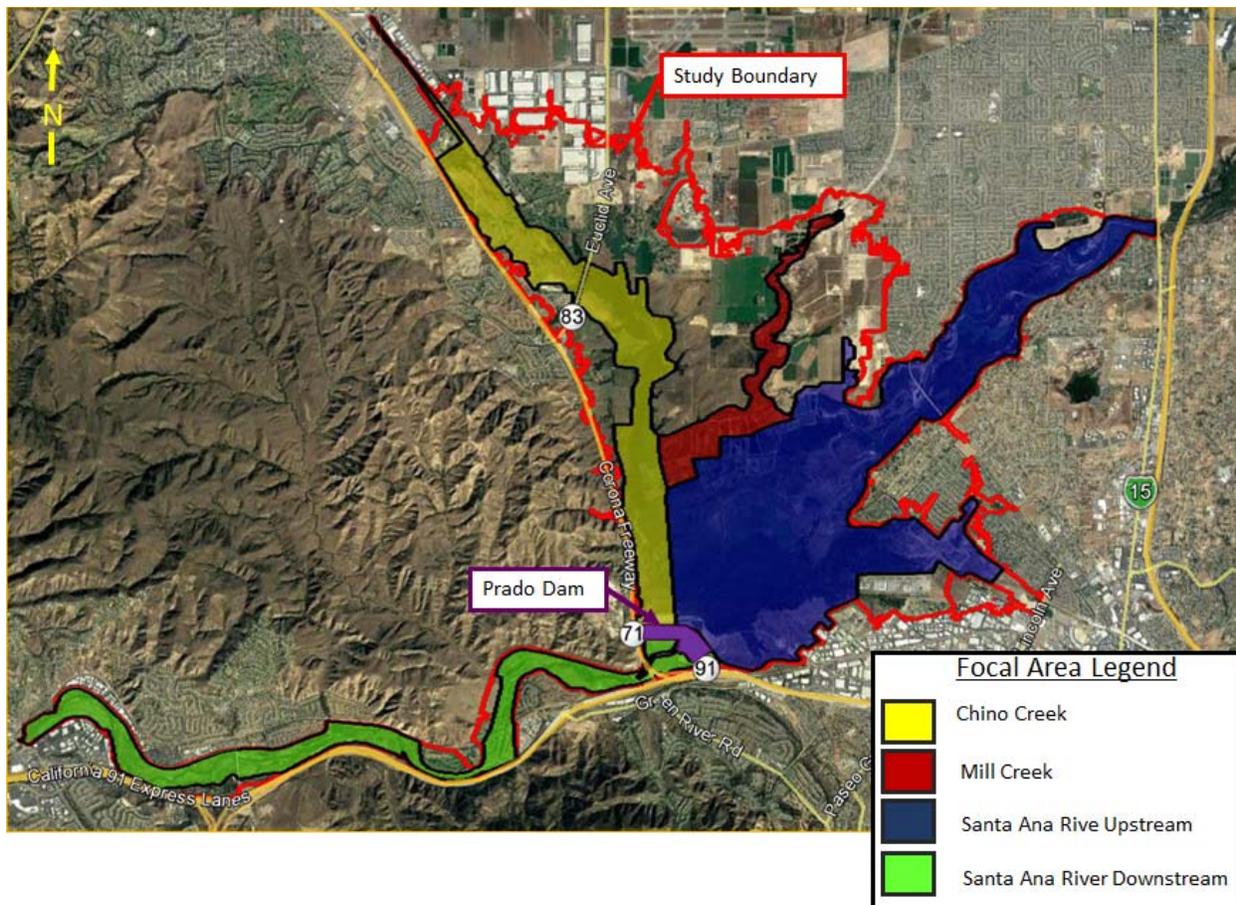
### **Mill Creek**

From where Mill Creek enters Prado Basin to approximately Hellman Avenue where the creek is channelized.

### **Santa Ana River (SAR) Downstream**

The portion of the Santa Ana River that extends downstream of Prado Dam for approximately 8 miles.

Each focal area is outlined in Figure 1 on the next page.



**Figure 1 – Project Focal Areas**

Separate measures for each focal area were developed by the PDT to address both aquatic riverine ecosystem restoration and water conservation. Work associated with the measures includes removal of vegetation, restoration of native vegetation, channel excavation, construction of a sediment slurry line, management of invasive birds and wild pigs, and construction of in stream habitat features. A brief description of each of the 25 identified measure can be found Attachment 1 – Measure Data Summary. Detailed figures and design information can be found in the Design Appendix.

Construction costs, adaptive management costs, and operation and maintenance costs were developed separately for each measure and are presented in Attachment 2 – Detailed Measure Cost Data. Construction costs include the work required to initially install or construct a feature while adaptive management costs include additional labor and work to monitor and modify the feature as necessary to ensure it will fulfill the environmental restoration objective. Operation and maintenances costs include costs incurred after the measure is constructed or installed and the measure is established to where it addresses the ecosystem restoration objective as intended.

After costs for each measure were developed, a habitat restoration value was determined and the costs and habitat values of each measure were used as inputs for a Cost Effective Incremental Cost Analysis (CEICA) to determine the final array of alternatives. The CEICA analysis

identified three best buy alternatives – Plan 9, Plan 11, and Plan 14. The measures in each of the three alternatives in the final array are summarized in the table below. A detailed description of each measure can be found in Attachment 1 – Measure Data Summary.

Focal Area	Measure ID	Measure Name	Alternatives		
			CEICA Plan 9	CEICA Plan 11	CEICA Plan 14
Santa Ana River - Upstream	SU-1A	Sediment Management		X	X
	SU-2	Invasive Plant Management	X	X	X
	SU-3	Riparian Edge Management		X	X
	SU-4	Feral Pig Management			X
	SU-5	In-Stream Habitat Features			X
	SU-6	Non-Native Aquatic Species Management		X	X
	SU-7	Cow Bird Trapping	X	X	X
	SU-8	Native Plantings	X	X	X
	WC-1	Water Conservation with incidental sediment removal	X		
Santa Ana River - Downstream	SD-2	In-Stream Habitat Features		X	X
	SD-3	Invasive Plant Management	X	X	X
	SD-4	Non-Native Aquatic Species Management			X
Chino Creek	CC-1	Invasive Plant Management	X	X	X
	CC-2D	Raise existing invert and encourage braided channels	X	X	X
	CC-6	Feral Pig Management			X
	CC-8	Cow Bird Trapping	X	X	X
	CC-10	Native Plantings	X	X	X
Mill Creek	MC-1	Invasive Plant Management	X	X	X
	MC-3	Feral Pig Management			X
	MC-5	Cow Bird Trapping	X	X	X
	MC-7	Native Plantings	X	X	X

**Table 1 – Measure Summary**

An Abbreviated Cost Risk Analysis (ACRA) was completed for each of the three best-buy alternatives and a Total Project Cost Summary (TPCS) was developed for each of the three alternatives.

The Tentatively Selected Plan (TSP) will be selected from the three bust-buy plans.

This cost engineering assessment is compliant with ER 1110-2-1302 - Civil Works Cost Engineering dated 30 June 2016.

## **2.0 Summary**

The following sections apply to the costs developed for each of the 25 measures.

### **2.1 Unit Cost Basis**

#### **2.1.1 Direct Costs**

Costs for each measure were determined using a combination of parametric data, estimates from PDT members, developing crews, and cost book information. Each measure was divided into separate major components and unit prices were developed based on the work necessary to construct each component. A single unit price was used for similar components found in multiple measures. A detailed breakdown of the components in each measure and a summary of all 30 unit costs used to develop the costs for each measure can be found in Attachment 2 – Detailed Measure Cost Data.

Unit costs developed using parametric data relied on data from past USACE projects within Prado Basin and immediately downstream of Prado Dam along with studies completed by Orange County Water District (OCWD). These projects included the following:

1. CIW Main Dike (September 2014)
2. Women’s Prison Dike Overbuild Contract (2013)
3. Reach 9, Phase 3 – Gypsum Canyon Road to Coal Canyon Road (2013)
4. Prado Basin Sediment Management Demonstration Project 60% Engineering Analysis (HDR Report, January 2013)
5. Prado Dam Basin Sediment By-Pass: Alternative Analysis (RBF Report, January 2014)
6. Orange County Water District (OCWD) cost information on dredging

Labor rates used to develop the estimate were provided from the latest Davis-Bacon Wage Rates January 2018

Equipment rates are based on the Department of the Army EP 1110-1-8 “Construction Equipment Ownership and Expense Schedule”, Volume 7, November 2016.

#### **2.1.2 Equipment Selection**

Equipment selection and sizing were developed using the cost estimator’s experience and input from other PDT members.

#### **2.1.3 Sales Tax**

Riverside county sales tax is 7.75%.

## **2.2 Indirect Costs**

1. Pre-construction, Engineering, and Design (PED) – 25%
2. Supervision and Administration during Construction (S&A) – 7%

## **2.3 Contractor Markups**

Contractor markups were only applied to unit costs that were based on developed crews and cost book items. The estimate included a prime with the following markups –

- Job Office Overhead – 15%
- Home Office Overhead – 10%
- Profit – 8%
- Bond - 2%

Sub-contractor markups were included on a limited number of items of work. The estimate included a sub-contractor with the following markups –

- Job Office Overhead – 8%
- Home Office Overhead – 10%
- Profit – 8%

All markups assume all work is being performed using the “Invitation for Bid” contract mechanism.

## **2.4 Federal and Non-Federal percent breakdown**

Federal and non-federal cost sharing percentages are 65% and 35%, respectively.

## **2.5 Abbreviated Cost Risk Analyses**

An Abbreviated Cost Risk Analyses was completed for the three alternatives in the final array. The results of the risk analysis can be found in Attachment 3 – Abbreviated Cost Risk Analysis.

## **2.6 Assumptions**

### **2.6.1 Site Access**

Site access is readily available and not special accommodations are required throughout the project area. For work within the SAR Downstream focal area, it was assumed that crews would use existing maintenance roads and ramps along the Sana Ana River to access the invert. These roads and ramps have been used for past USACE projects within the focal area and are expected to be readily available for future projects. For work upstream of Prado Dam, within the Chino Creek, Mill Creek, and SAR Upstream focal Areas, it was assumed crews would use existing access roads within the basin. Prado Basin is maintained by the local sponsor for this study.

### **2.6.2 Haul Routes**

For all excavation activities, it is assumed any excess material is transported no more than 3000 FT from the excavation site. The excess material will either be placed within the focal area

where the work is being conducted and graded to create landscape features or hauled to a pre-selected disposal site within Prado Basin. No material will be hauled out of the project area.

### **2.6.3 Green waste**

All vegetation removed will be processed into mulch and the material will be transported no more than 3000 FT from the processing site. The mulch material will be spread and used as ground cover within the project area. No vegetation that is removed will be hauled out of the project area.

### **2.6.4 Construction Period**

All construction activities will occur during the historically dry period between March and October. This will ensure minimal surface flows within the focal areas and minimize the need for diversion and control of water.

### **2.6.5 Schedule of Work**

Assume work schedule: 5 days per week, 8 hours per day.

## **3.0 Synopsis**

In Summary, the Current Working Estimates (CWE) for CIECIA Plans 9, 11, and 14 in 2018 price levels are presented in Attachment 4 – Alternatives Total Project Cost Summary and are summarized in the table below.

Plan 9	\$29,336,171
Plan 11	\$127,737,928
Plan 14	\$134,901,106

**Table 2 - Alternative Costs**

## **Attachment 1 – Measure Data Summary**

**Measure Data Summary**

Focal Area	Measure ID	Measure Name	Measure Description	Measure Costs			Alternatives		
				Construction	O&M	Adaptive Management	CEICA Plan 9	CEICA Plan 11	CEICA Plan 14
Santa Ana River - Upstream	SU-1A	Sediment Management	Sediment would be removed from Prado Basin and re-entrained into the lower Santa Ana River below Prado Dam by a combination of an entrainment groin fore bay to guide mainstem Santa Ana River stream flow to the entrainment groin, which would be formed of, rip rap and derrick stone, a transition channel upstream of the trap with instream habitat features, the sediment trap, two sediment storage and processing areas, and a sediment re-entrainment system. The OCWD wetlands pilot channel would also be extended up to the entrainment groin, along with an inlet in the groin. The transition channel would also include three fill areas where material would be placed to provide for the design gradient in the transition channel, along with an expansive floodplain area adjacent to the transition channel that would host native plantings at the pheasant field area. Sediment re-entrainment would be accomplished by mixing sorted sand with water that would then be pumped as a slurry around the Auxiliary Dike of the Prado Dam and then discharged at the end of the downstream outlet channel structure. Pumps would be used to deliver the slurry via two 24-inch diameter pipes over a length of 2,600 feet each. Monitoring would occur over the first 5 years of the project to help inform sediment transport and deposition trends and habitat responses. Monitoring would inform potential changes in amounts of sediment that can be re-entrained per volume of water and at what release rates re-entrainment effects are suitable for downstream habitat and management.	\$ 42,470,847	\$ 7,112,509	\$ 10,000		X	X
	SU-2	Invasive Plant Management	The Invasive Plant Management Measure includes activities to remove the initial biomass of invasive plants and follow on herbicide application and biomass removal techniques for a period of five years. Therefore, the initial invasive plant management effort would be for a period of approximately 6 years. The measure also includes the planting and management of native species to promote the re-establishment of native vegetation communities in areas that have been treated to remove invasive plants. Once the initial biomass of invasive vegetation has been removed from a target area, regular inspection and maintenance would occur over the 50 year life of the project to ensure that invasive plants are not re-established in treated areas. Monitoring of the implementation area would occur during and following the first six year implementation effort. Retreatments during the first 6 years are factored into the construction effort and cost. Follow on treatments to address return of invasive plants identified by monitoring would likely be necessary in subsequent years, especially following large disturbances such high flow events and fires. Most treatments would be expected to be much smaller in scale than the initial effort during the construction phase	\$ 3,306,000	\$ 348,880	\$ -	X	X	X
	SU-3	Riparian Edge Management	This measure includes invasive plant removal, native plantings, vegetation trimming and maintenance to maintain a thriving riparian edge. Riparian edge management would be conducted along the proposed sediment removal trap channels and OCWD diversion channel. Adaptive management measures may include changed in level of effort and/or frequency of treatments to manage non-native plant presence or the addition of more edge management areas if roadways reveal the need for this type of management.	\$ 1,072,239	\$ 19,580	\$ -		X	X
	SU-4	Feral Pig Management	The Feral Pig Management Measure would provide for the control of feral pigs through a combination trapping, telemetry and other population control techniques. Feral pigs will be trapped using box traps, corral traps, panelized corral traps or other similar methods. Adaptive management measures include initial trapping efforts and subsequent monitoring of pigs fitted with GPS collars would be followed on with similar efforts. The locations for traps would be informed by lessons learned from GPS data gathered from "Judas" pigs, field observations, and camera trap results.	\$ 301,665	\$ 60,333	\$ -			X
	SU-5	In-Stream Habitat Features	In-stream habitat features would be composed of approximately 15 rock groins, measuring 10 ft. x 45 ft. (450 sq. ft.). Monitoring of invert grade, channel depth, sediment aggradation and scour will be monitored to help determine potential adaptive management needs. Potential adaptive management activities are expected to include periodic repair to the in-stream habitat features due to damage from high flows, augmentation or removal of rock depending on observed and intended effect to geomorphology and associated aquatic habitat in the vicinity of the features.	\$ 1,951,852	\$ 918	\$ -			X
	SU-6	Non-Native Aquatic Species Management	The Non-Native Aquatic Species Management Measure includes activities to control and/or remove invasive aquatic species. The focus would be on large predatory fish species, such as carp, bass, and catfish that prey on native fish such as the Santa Ana sucker and arroyo chub. A combination of removal techniques such as netting, seining or electroshocking could be used. Efforts to implement non-native aquatic species management will occur after large flow events that push many of the non-native species downstream. Removal efforts would utilize electroshocking, seining, and dip nets, or other similar methods to remove non-native aquatic species from the system. Non-native aquatic species management events are only expected to occur an average of 2-5 times per year, with 1-2 days spent on each watercourse per event.	\$ 400,000	\$ 80,000	\$ -		X	X

**Measure Data Summary**

Focal Area	Measure ID	Measure Name	Measure Description	Measure Costs			Alternatives		
				Construction	O&M	Adaptive Management	CEICA Plan 9	CEICA Plan 11	CEICA Plan 14
	SU-7	<b>Cow Bird Trapping</b>	The Cow Bird Trapping Measure would provide control for this non-native avian species. The components of the measure would include trapping and other population control measure.	\$ 278,250	\$ 55,650	\$ -	<b>X</b>	<b>X</b>	<b>X</b>
	SU-8	<b>Native Plantings</b>	The Native Plantings Measure will be carried out at locations identified for restoration of native vegetation where minimal removal of invasive plants would be required prior to vegetation with native plants. Plantings would include seeding, pole staking, and planting of nursery-grown plants at areas that have reduced vegetative cover. The site would require some site preparation, but it is expected to be minimal in comparison to the Invasive Plant Management measure. Site preparation is expected to include minor grading and a minimal amount of weed management. Regular monitoring would be required to document the growth of the plantings and any potential weed or other issues. Supplemental watering may be required during the plant establishment period, which would be assumed to be limited to the first two years after implementation.	\$ 976,826	\$ 18,690	\$ 13,000	<b>X</b>	<b>X</b>	<b>X</b>
	WC-1	<b>Water Conservation with incidental sediment removal</b>	The measure would permit the surface water elevation at Prado Dam to operate up to 505 ft. mean sea level (MSL) year-round for additional water conservation. The Water Conservation measure would include two sediment removal actions to address habitat impacts associated with induced sediment accumulation along the Santa Ana River upstream of the dam. 125,000 cubic yards of sediment would be removed from the upstream reach of the Santa Ana River in two events for a total removal of 250,000 cubic yards of sediment excavated and placed in the sediment placement areas (Area A and Area B) to address additional sediment accumulation that would occur due to water conservation operations over the period of analysis	\$ 1,550,534	\$ 100,000	\$ -	<b>X</b>		
Santa Ana River - Downstream	SD-2	<b>In-Stream Habitat Features</b>	15 in-stream habitat features, measuring 70 ft. x 100 ft. (7,000 sq. ft.) each would be constructed. Monitoring of invert grade, channel depth, sediment aggradation and scour will be monitored to help determine potential adaptive management needs. Potential adaptive management activities are expected to include periodic repair to the in-stream habitat features due to damage from high flows, augmentation or removal of rock depending on observed and intended effect to geomorphology and associated aquatic habitat in the vicinity of the features.	\$ 5,498,018	\$ -	\$ -		<b>X</b>	<b>X</b>
	SD-3	<b>Invasive Plant Management</b>	The Invasive Plant Management Measure includes activities to remove the initial biomass of invasive plants and follow on herbicide application and biomass removal techniques for a period of five years. Therefore, the initial invasive plant management effort would be for a period of approximately 6 years. The measure also includes the planting and management of native species to promote the re-establishment of native vegetation communities in areas that have been treated to remove invasive plants. Once the initial biomass of invasive vegetation has been removed from a target area, regular inspection and maintenance would occur over the 50 year life of the project to ensure that invasive plants are not re-established in treated areas. Monitoring of the implementation area would occur during and following the first six year implementation effort. Retreatments during the first 6 years are factored into the construction effort and cost. Follow on treatments to address return of invasive plants identified by monitoring would likely be necessary in subsequent years, especially following large disturbances such high flow events and fires. Most treatments would be expected to be much smaller in scale than the initial effort during the construction phase	\$ 358,100	\$ 52,510	\$ -	<b>X</b>	<b>X</b>	<b>X</b>
	SD-4	<b>Non-Native Aquatic Species Management</b>	The Non-Native Aquatic Species Management Measure includes activities to control and/or remove invasive aquatic species. The focus would be on large predatory fish species, such as carp, bass, and catfish that prey on native fish such as the Santa Ana sucker and arroyo chub. A combination of removal techniques such as netting, seining or electroshocking could be used. Efforts to implement non-native aquatic species management will occur after large flow events that push many of the non-native species downstream. Removal efforts would utilize electroshocking, seining, and dip nets, or other similar methods to remove non-native aquatic species from the system. Non-native aquatic species management events are only expected to occur an average of 2-5 times per year, with 1-2 days spent on each watercourse per event.	\$ 480,000	\$ 96,000	\$ -			<b>X</b>

**Measure Data Summary**

Focal Area	Measure ID	Measure Name	Measure Description	Measure Costs			Alternatives		
				Construction	O&M	Adaptive Management	CEICA Plan 9	CEICA Plan 11	CEICA Plan 14
Chino Creek	CC-1	Invasive Plant Management	The Invasive Plant Management Measure includes activities to remove the initial biomass of invasive plants and follow on herbicide application and biomass removal techniques for a period of five years. Therefore, the initial invasive plant management effort would be for a period of approximately 6 years. The measure also includes the planting and management of native species to promote the re-establishment of native vegetation communities in areas that have been treated to remove invasive plants. Once the initial biomass of invasive vegetation has been removed from a target area, regular inspection and maintenance would occur over the 50 year life of the project to ensure that invasive plants are not re-established in treated areas. Monitoring of the implementation area would occur during and following the first six year implementation effort. Retreatments during the first 6 years are factored into the construction effort and cost. Follow on treatments to address return of invasive plants identified by monitoring would likely be necessary in subsequent years, especially following large disturbances such high flow events and fires. Most treatments would be expected to be much smaller in scale than the initial effort during the construction phase	\$ 1,159,000	\$ 213,600	\$ -	X	X	X
	CC-2C	Raise existing invert and cut new channel	Includes raising the invert of Chino Creek starting at approximately Pine Ave and construction of berms, grade stabilizers, and maintenance roads.	\$ 4,263,588	\$ 56,090	\$ 26,000			
	CC-2D	Raise existing invert and encourage braided channels	Raises the existing channel invert starting at approximately Pine Ave. and re-constructing to channel to include additional bends. Reconnects with existing invert just upstream of Euclid Ave.	\$ 4,191,192	\$ 56,090	\$ 26,000	X	X	X
	CC-3	In-Stream Habitat Features	15 in-stream habitat features, measuring 70 ft. x 100 ft. (7,000 sq. ft.) each would be constructed. Monitoring of invert grade, channel depth, sediment aggradation and scour will be monitored to help determine potential adaptive management needs. Potential adaptive management activities are expected to include periodic repair to the in-stream habitat features due to damage from high flows, augmentation or removal of rock depending on observed and intended effect to geomorphology and associated aquatic habitat in the vicinity of the features.	\$ 312,593	\$ 9,053	\$ -			
	CC-5	Non-Native Aquatic Species Management	The Non-Native Aquatic Species Management Measure includes activities to control and/or remove invasive aquatic species. The focus would be on large predatory fish species, such as carp, bass, and catfish that prey on native fish such as the Santa Ana sucker and arroyo chub. A combination of removal techniques such as netting, seining or electroshocking could be used. Efforts to implement non-native aquatic species management will occur after large flow events that push many of the non-native species downstream. Removal efforts would utilize electroshocking, seining, and dip nets, or other similar methods to remove non-native aquatic species from the system. Non-native aquatic species management events are only expected to occur an average of 2-5 times per year, with 1-2 days spent on each watercourse per event.	\$ 280,000	\$ 56,000	\$ -			
	CC-6	Feral Pig Management	The Feral Pig Management Measure would provide for the control of feral pigs through a combination trapping, telemetry and other population control techniques. Feral pigs will be trapped using box traps, corral traps, panelized corral traps or other similar methods. Adaptive management measures include initial trapping efforts and subsequent monitoring of pigs fitted with GPS collars would be followed on with similar efforts. The locations for traps would be informed by lessons learned from GPS data gathered from "Judas" pigs, field observations, and camera trap results.	\$ 301,665	\$ 60,333	\$ -			X
	CC-8	Cow Bird Trapping	The Cow Bird Trapping Measure would provide control for this non-native avian species. The components of the measure would include trapping and other population control measure.	\$ 278,250	\$ 55,650	\$ -	X	X	X
	CC-10	Native Plantings	The Native Plantings Measure will be carried out at locations identified for restoration of native vegetation where minimal removal of invasive plants would be required prior to vegetation with native plants. Plantings would include seeding, pole staking, and planting of nursery-grown plants at areas that have reduced vegetative cover. The site would require some site preparation, but it is expected to be minimal in comparison to the Invasive Plant Management measure. Site preparation is expected to include minor grading and a minimal amount of weed management. Regular monitoring would be required to document the growth of the plantings and any potential weed or other issues. Supplemental watering may be required during the plant establishment period, which would be assumed to be limited to the first two years after implementation.	\$ 1,708,496	\$ 19,046	\$ 13,000	X	X	X

**Measure Data Summary**

Focal Area	Measure ID	Measure Name	Measure Description	Measure Costs			Alternatives		
				Construction	O&M	Adaptive Management	CEICA Plan 9	CEICA Plan 11	CEICA Plan 14
Mill Creek	MC-1	Invasive Plant Management	The Invasive Plant Management Measure includes activities to remove the initial biomass of invasive plants and follow on herbicide application and biomass removal techniques for a period of five years. Therefore, the initial invasive plant management effort would be for a period of approximately 6 years. The measure also includes the planting and management of native species to promote the re-establishment of native vegetation communities in areas that have been treated to remove invasive plants. Once the initial biomass of invasive vegetation has been removed from a target area, regular inspection and maintenance would occur over the 50 year life of the project to ensure that invasive plants are not re-established in treated areas. Monitoring of the implementation area would occur during and following the first six year implementation effort. Retreatments during the first 6 years are factored into the construction effort and cost. Follow on treatments to address return of invasive plants identified by monitoring would likely be necessary in subsequent years, especially following large disturbances such high flow events and fires. Most treatments would be expected to be much smaller in scale than the initial effort during the construction phase	\$ 966,190	\$ 21,004	\$ -	X	X	X
	MC-2	Non-Native Aquatic Species Management	The Non-Native Aquatic Species Management Measure includes activities to control and/or remove invasive aquatic species. The focus would be on large predatory fish species, such as carp, bass, and catfish that prey on native fish such as the Santa Ana sucker and arroyo chub. A combination of removal techniques such as netting, seining or electroshocking could be used. Efforts to implement non-native aquatic species management will occur after large flow events that push many of the non-native species downstream. Removal efforts would utilize electroshocking, seining, and dip nets, or other similar methods to remove non-native aquatic species from the system. Non-native aquatic species management events are only expected to occur an average of 2-5 times per year, with 1-2 days spent on each watercourse per event.	\$ 200,000	\$ 40,000	\$ -			
	MC-3	Feral Pig Management	The Feral Pig Management Measure would provide for the control of feral pigs through a combination trapping, telemetry and other population control techniques. Feral pigs will be trapped using box traps, corral traps, panelized corral traps or other similar methods. Adaptive management measures include initial trapping efforts and subsequent monitoring of pigs fitted with GPS collars would be followed on with similar efforts. The locations for traps would be informed by lessons learned from GPS data gathered from "Judas" pigs, field observations, and camera trap results.	\$ 301,665	\$ 60,333	\$ -			X
	MC-5	Cow Bird Trapping	The Cow Bird Trapping Measure would provide control for this non-native avian species. The components of the measure would include trapping and other population control measure.	\$ 278,250	\$ 55,650	\$ -	X	X	X
	MC-7	Native Plantings	The Native Plantings Measure will be carried out at locations identified for restoration of native vegetation where minimal removal of invasive plants would be required prior to vegetation with native plants. Plantings would include seeding, pole staking, and planting of nursery-grown plants at areas that have reduced vegetative cover. The site would require some site preparation, but it is expected to be minimal in comparison to the Invasive Plant Management measure. Site preparation is expected to include minor grading and a minimal amount of weed management. Regular monitoring would be required to document the growth of the plantings and any potential weed or other issues. Supplemental watering may be required during the plant establishment period, which would be assumed to be limited to the first two years after implementation.	\$ 461,797	\$ 8,900	\$ 13,000	X	X	X

## **Attachment 2 – Detailed Measure Cost Data**

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
CC-1	Invasive Plant Management	\$ 1,159,000								
			Planting Riparian Forrest	8.63	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 81,938	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	8.63	AC	Planting - Riparian Scrub	\$ 8,500	\$ 73,313	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Transitional Scrub	8.63	AC	Planting - Transitional Scrub	\$ 8,500	\$ 73,313	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	20.00	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 28,000	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	49.00	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 514,500	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	17.25	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 310,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			HydroSeeding	8.63	AC	Planting - Hydro Seeding	\$ 5,500	\$ 47,438	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Willow Clippings	300.00	EA	Planting - Willow Clippings	\$ 100	\$ 30,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
CC-10	Native Plantings	\$ 1,708,496								
			Riparian Edge Management	1.84	AC	Planting - Landscape Maintenance	\$ 10,000	\$ 18,365	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Forrest	28.00	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 266,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	14.00	AC	Planting - Riparian Scrub	\$ 8,500	\$ 119,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	32.15	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 45,014	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	10.72	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 112,534	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	69,163.60	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 622,472	Excavation and Site Grading	09 01 CHANNELS
			Decomposed Granite	222.22	C.Y.	Misc. Construction - DG Maintenance Road	\$ 95	\$ 21,111	All Other	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	28.00	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 504,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
CC-2C	Raise existing invert and cut new channel	\$ 4,263,588								
			Invasive Plant Management (Small Scale)	13.51	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 120,248	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Invasive Plant Management (Large Scale)	13.51	AC	Clearing - Medium Vegetation	\$ 2,200	\$ 29,724	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Riparian Edge Management	4.65	AC	Planting - Landscape Maintenance	\$ 10,000	\$ 46,488	Site Restoration	06 FISH AND WILDLIFE FACILITIES

**Detailed Measure Costs - Operation and Maintenance**

Measure ID	Measure Name	Annual Cost	Measure Component	Quantity	Unit of Measure	Unit Price Description	Unit Price	Sub Total
WC-1	Water Conservation with incidental sediment removal	\$ 100,000	Additional Staff for Operations	1.00	YR		\$ 100,000	\$ 100,000
SU-1A	Sediment Management	\$ 7,112,509						
			Rough Grading (Cut, Fill & Compaction)	496,809.00	CY	Earthwork - Excavate and Place Material	\$ 9	\$ 4,471,281
			Slurry Material Downstream	200,000.00	CY	Sediment Transport System - Pump Material Downstream	\$ 12	\$ 2,400,000
			Down strem sediment removal	17,292.00	CY	Earthwork - Excavate and Place Material	\$ 9	\$ 155,628
			Clearing and Grubbing (Light)	26.50	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,300	\$ 34,450
			Sed Accumulation Mmonitoring	1.00	EA	Annual Monitoring and Data Evaluation costs	\$ 51,150	\$ 51,150
SU-2	Invasive Plant Management	\$ 348,880						
			Invasive Plant Management (Small Scale)	39.20	CY	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 348,880
SU-3	Riparian Edge Management	\$ 19,580						
			Invasive Plant Management (Small Scale)	2.20	CY	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 19,580
SU-4	Feral Pig Management	\$ 60,333						
			Feral Pigs Management	1.00	YR	Species Removal - Feral Pig	\$ 60,333	\$ 60,333
SU-5	In-Stream Habitat Features	\$ 918						
			Rough Grading (Cut, Fill & Compaction)	102.00	CY	Earthwork - Excavate and Place Material	\$ 9	\$ 918
SU-6	Non-Native Aquatic Species Management	\$ 80,000						
			Non-Native Aquatic Species Management	1.00	YR	Species Removal - Non-Native Aquatic	\$ 80,000	\$ 80,000
SU-7	Cow Bird Trapping	\$ 55,650						
			Cow Bird Trapping	1.00	YR	Species Remove - Cow Bird	\$ 55,650	\$ 55,650
SU-8	Native Plantings	\$ 18,690						
			Invasive Plant Management (Small Scale)	2.10	CY	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 18,690
SD-2	In-Stream Habitat Features	\$ -						
SD-3	Invasive Plant Management	\$ 52,510						
			Invasive Plant Management (Small Scale)	5.90	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 52,510
SD-4	Non-Native Aquatic Species Management	\$ 96,000						
			Non-Native Aquatic Species Management	1.00	YR	Species Removal - Non-Native Aquatic	\$ 96,000	\$ 96,000
CC-1	Invasive Plant Management	\$ 213,600						
			Invasive Plant Management (Small Scale)	24.00	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 213,600
CC-2C	Raise existing invert and cut new channel	\$ 56,090						
			Rough Grading (Cut, Fill & Compaction)	200.00	CY	Earthwork - Excavate and Place Material	\$ 9	\$ 1,800
			Invasive Plant Management (Small Scale)	6.10	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 54,290
CC-2D	Raise existing invert and encourage braided channels	\$ 56,090						
			Rough Grading (Cut, Fill & Compaction)	200.00	CY	Earthwork - Excavate and Place Material	\$ 9	\$ 1,800
			Invasive Plant Management (Small Scale)	6.10	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 54,290
CC-3	In-Stream Habitat Features	\$ 9,053						
			Rough Grading (Cut, Fill & Compaction)	17.00	CY	Earthwork - Excavate and Place Material	\$ 9	\$ 153
			Invasive Plant Management (Small Scale)	1.00	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 8,900
CC-5	Non-Native Aquatic Species Management	\$ 56,000						
			Non-Native Aquatic Species Management	1.00	YR	Species Removal - Non-Native Aquatic	\$ 56,000	\$ 56,000
CC-6	Feral Pig Management	\$ 60,333						
			Feral Pigs Management	1.00	YR	Species Removal - Feral Pig	\$ 60,333	\$ 60,333
CC-8	Cow Bird Trapping	\$ 55,650						
			Cow Bird Trapping	1.00	YR	Species Remove - Cow Bird	\$ 55,650	\$ 55,650
CC-10	Native Plantings	\$ 19,046						
			Invasive Plant Management (Small Scale)	2.14	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 19,046
MC-1	Invasive Plant Management	\$ 21,004						
			Invasive Plant Management (Small Scale)	2.36	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 21,004
MC-2	Non-Native Aquatic Species Management	\$ 40,000						
			Non-Native Aquatic Species Management	1.00	YR	Species Removal - Non-Native Aquatic	\$ 40,000	\$ 40,000
MC-3	Feral Pig Management	\$ 60,333						
			Feral Pigs Management	1.00	YR	Species Removal - Feral Pig	\$ 60,333	\$ 60,333
MC-5	Cow Bird Trapping	\$ 55,650						
			Cow Bird Trapping	1.00	YR	Species Remove - Cow Bird	\$ 55,650	\$ 55,650
MC-7	Native Plantings	\$ 8,900						
			Invasive Plant Management (Small Scale)	1.00	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 8,900

**Detailed Measure Costs - Adaptive Management**

Measure ID	Measure Name	Adaptive Management Cost	Measure Component	Quantity	UOM	Unit Price	Sub Total
CC-2C	Raise existing invert and cut new channel	\$ 26,000	Adaptive Management	1.00	YR	\$ 13,000	\$ 13,000
			Biologist Inspections	1.00	YR	\$ 13,000	\$ 13,000
CC-2D	Raise existing invert and encourage braided channels	\$ 26,000	Adaptive Management	1.00	YR	\$ 13,000	\$ 13,000
			Biologist Inspections	1.00	YR	\$ 13,000	\$ 13,000
SU-1A	Sediment Management	\$ 10,000	Adaptive Management	1.00	YR	\$ 10,000	\$ 10,000
SU-8	Native Plantings	\$ 13,000	Biologist Inspections	1.00	YR	\$ 13,000	\$ 13,000
CC-10	Native Plantings	\$ 13,000	Biologist Inspections	1.00	YR	\$ 13,000	\$ 13,000
MC-7	Native Plantings	\$ 13,000	Biologist Inspections	1.00	YR	\$ 13,000	\$ 13,000

Measure Component Description	Unit Price Description	UOM	Unit Price	Source	Notes
Clearing and Grubbing (Heavy)	Clearing - Grubbing and Clearing Heavy Vegetation	AC	\$ 10,500	Developed Crew	Includes Clearing-Grubbing Site and Clearing-Heavy Vegetation. Added 5% to Mii cost to account for Mob/Demob
Invasive Plant Management (Large Scale)	Clearing - Medium Vegetation	AC	\$ 2,200	Developed Crew	Assumes all non arundo material is disposed of within the basin. Used as cover or placed ontop of misc fill. Added 5% to Mii cost to account for Mob/Demob
Invasive Plant Management (Small Scale)	Clearing - Light Vegetation, By Hand	AC	\$ 8,900	Developed Crew	Assumes all non arundo material is disposed of within the basin. Used as cover or placed ontop of misc fill. Added 5% to Mii cost to account for Mob/Demob
Clearing and Grubbing (Light)	Clearing - Light Vegetation, With Heavy Equipment	AC	\$ 1,400	Developed Crew	Assumes all non arundo material is disposed of within the basin. Used as cover or placed ontop of misc fill. Added 5% to Mii cost to account for Mob/Demob
RCP 30"	Culvert - 30" RCP	LF	\$ 200	Costbook	Added 5% to Mii cost to account for Mob/Demob
RCP 48"	Culvert - 48" RCP	LF	\$ 330	Costbook	Added 5% to Mii cost to account for Mob/Demob
RCP 15"	Culvert - 15" RCP	LF	\$ 63	Costbook	Added 5% to Mii cost to account for Mob/Demob
Stormdrain Inlet and Outlet	Culvert - Inlet & Outlet	LS	\$ 42,000	PDT Estimate	
Rough Grading (Cut, Fill & Compaction)	Earthwork - Excavate and Place Material	CY	\$ 9	Developed Crew	Assumes material is excavated, placed in a off highway dump truck and hauled no more than 3000 FT where it is placed as misc fill (no compaction, graded to drain using scrappers and dozers). Includes Mob/Demob costs
Finish Grading	Earthwork - Re-Grade Site	AC	\$ 600	Developed Crew	Added 5% to Mii cost to account for Mob/Demob
Feral Pigs Management	Species Removal - Feral Pig	YR	\$ 60,333	PDT Estimate	Based on Biologists research and experience on past projects.
Non-Native Aquatic Species Management	Species Removal - Non-Native Aquatic	YR	\$ 55,650	Developed Crew	Added 5% to Mii cost to account for Mob/Demob
Cow Bird Trapping	Species Remove - Cow Bird	YR	\$ 55,650	Developed Crew	Added 5% to Mii cost to account for Mob/Demob
Rip Rap Class III (2 foot dia, 500 lbs)	Misc. Construction - 24" Riprap	CY	\$ 70	Parametric	
Reinforced Concrete	Misc. Construction - Concrete Pad for Erosion Control	CY	\$ 650	PDT Estimate	
Derrick Stone (3 foot dia, 3,000 lbs)	Misc. Construction - Derrick Stone	CY	\$ 200	Developed Crew	Added 5% to Mii cost to account for Mob/Demob

Measure Component Description	Unit Price Description	UOM	Unit Price	Source	Notes
Filter Fabric	Misc. Construction - Filter Fabric	SY	\$ 4	Costbook	Added 5% to Mii cost to account for Mob/Demob
Fencing	Misc. Construction - Wild Life Fence	LF	\$ 56	PDT Estimate	
Decomposed Granite	Misc. Construction - DG Maintenance Road	CY	\$ 95	Parametric	
Grouted Stone	Misc. Construction - Grouted Stone (Grout Plus Riprap Class II)	CY	\$ 160	Parametric	
Rip Rap Class I (0.8 foot dia, 50 lbs)	Misc. Construction - Place Mixed Stone	CY	\$ 100	Developed Crew	Added 5% to Mii cost to account for Mob/Demob
Planting Transitional Scrub	Planting - Transitional Scrub	AC	\$ 8,500	PDT Estimate	Based on input from Biologist, Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement
HydroSeeding	Planting - Hydro Seeding	AC	\$ 5,500	PDT Estimate	Based on input from Biologist, Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement
Planting Riparian Forrest	Planting - Riparian Edge Forrest	AC	\$ 9,500	PDT Estimate	Based on input from Biologist, Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement
Planting Riparian Scrub	Planting - Riparian Scrub	AC	\$ 8,500	PDT Estimate	Based on input from Biologist, Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement
Temporary Irrigation	Planting - Temporary Irrigation	AC	\$ 18,000	PDT Estimate	Based on input from Biologist, Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement
Riparian Edge Management	Planting - Landscape Maintenance	AC	\$ 10,000	PDT Estimate	Based on input from Biologist, Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement
Willow Clippings	Planting - Willow Clippings	EA	\$ 100	PDT Estimate	Based on input from Biologist, Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement

Measure Component Description	Unit Price Description	UOM	Unit Price	Source	Notes
Sediment Transport System	Sediment Transport System - Downstream of Prado Dam (24" Pipe)	LF	\$ 253	PDT Estimate	Slurry Pipeline, \$250/LF (direct bare cost). Add Choke station for energy dissipation on the downstream end - \$100,000, two hydro cyclones to help remove solids from the water – \$80,000. Assuming 52,000 LF of pipe and a total cost of \$13,180,000, base unit cost is \$253/LF Prices already include contractor markups
Slurry Material Downstream	Sediment Transport System - Pump Material Downstream	CY	\$ 12	PDT Estimate	Mob/Demob cost for miniature dredges – 400,000 1 Dozers to move material at the stock pile site - \$150 per HR, \$1200 Per day. Dozer is already included in channel sediment removal costs. Two, 8" portable hydraulic dredge to pump out slurry to the designated site. Dredge/pump will need 30" of draft. Assume production rate averages 50 cy/hr (solids) pumping 1,600 gpm (4% solid, 96% water). Total production of 100 CY/HR and a cost of \$8000 per day. If crews are removing 200,000 CYs, then pumps will be running for 250 Days $250 * 8,000 + 400,000 = 2,400,00$ $2,400,000/200,000 = 12 \$/CY$ All costs include contractor markups
Maintenance Road	Misc. Construction - DG Maintenance Road	CY	\$ 115	Parametric	Based on input from Landscape Architect, Civil Designer, and Local sponsor. Team members reached a consensus based on past projects and professional judgement
Sediment Transport System Monitoring	Annual Monitoring Pgm Costs	EA	\$ 51,150	PDT Estimate	Includes annual and semiannual topo bathy surveys and monthly visuals

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
			Planting Riparian Forrest	31.41	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 298,395	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	22.17	AC	Planting - Riparian Scrub	\$ 8,500	\$ 188,445	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Transitional Scrub	61.46	AC	Planting - Transitional Scrub	\$ 8,500	\$ 522,410	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	90.07	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 126,103	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	30.02	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 315,257	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	72,501.85	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 652,517	Excavation and Site Grading	09 01 CHANNELS
			Filter Fabric	1,333.33	S.Y.	Misc. Construction - Filter Fabric	\$ 4	\$ 5,600	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Rip Rap Class III (2 foot dia, 500 lbs)	2,200.00	C.Y.	Misc. Construction - 24" Riprap	\$ 70	\$ 154,000	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Grouted Stone	544.44	C.Y.	Misc. Construction - Grouted Stone (Grout Plus Riprap Class II)	\$ 160	\$ 87,111	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Reinforced Concrete	88.89	C.Y.	Misc. Construction - Concrete Pad for Erosion Control	\$ 650	\$ 57,778	All Other	06 FISH AND WILDLIFE FACILITIES
			RCP 15"	550.00	L.F.	Culvert - 15" RCP	\$ 63	\$ 34,650	All Other	06 FISH AND WILDLIFE FACILITIES
			Stormdrain Inlet and Outlet	1.00	LS	Culvert - Inlet & Outlet	\$ 42,000	\$ 42,000	All Other	06 FISH AND WILDLIFE FACILITIES
			Fencing	16,897.00	L.F.	Misc. Construction - Wild Life Fence	\$ 56	\$ 946,232	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Decomposed Granite	750.00	C.Y.	Misc. Construction - DG Maintenance Road	\$ 95	\$ 71,250	All Other	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	31.41	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 565,380	Site Restoration	06 FISH AND WILDLIFE FACILITIES
CC-2D	Raise existing invert and encourage braided channels	\$ 4,191,192								
			Invasive Plant Management (Small Scale)	13.66	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 121,617	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Invasive Plant Management (Large Scale)	13.66	AC	Clearing - Medium Vegetation	\$ 2,200	\$ 30,063	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Riparian Edge Management	4.65	AC	Planting - Landscape Maintenance	\$ 10,000	\$ 46,488	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Forrest	42.92	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 407,740	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	43.66	AC	Planting - Riparian Scrub	\$ 8,500	\$ 371,110	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Transitional Scrub	29.75	AC	Planting - Transitional Scrub	\$ 8,500	\$ 252,875	Site Restoration	06 FISH AND WILDLIFE FACILITIES

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
			Clearing and Grubbing (Light)	91.10	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 127,539	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	30.37	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 318,847	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	37,535.81	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 337,822	Excavation and Site Grading	09 01 CHANNELS
			Filter Fabric	2,000.00	S.Y.	Misc. Construction - Filter Fabric	\$ 4	\$ 8,400	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Rip Rap Class III (2 foot dia, 500 lbs)	2,866.67	C.Y.	Misc. Construction - 24" Riprap	\$ 70	\$ 200,667	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Grouted Stone	272.22	C.Y.	Misc. Construction - Grouted Stone (Grout Plus Riprap Class II)	\$ 160	\$ 43,555	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Reinforced Concrete	88.89	C.Y.	Misc. Construction - Concrete Pad for Erosion Control	\$ 650	\$ 57,778	All Other	06 FISH AND WILDLIFE FACILITIES
			RCP 15"	550.00	L.F.	Culvert - 15" RCP	\$ 63	\$ 34,650	All Other	06 FISH AND WILDLIFE FACILITIES
			Stormdrain Inlet and Outlet	1.00	LS	Culvert - Inlet & Outlet	\$ 42,000	\$ 42,000	All Other	06 FISH AND WILDLIFE FACILITIES
			Fencing	16,897.00	L.F.	Misc. Construction - Wild Life Fence	\$ 56	\$ 946,232	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Decomposed Granite	750.00	C.Y.	Misc. Construction - DG Maintenance Road	\$ 95	\$ 71,250	All Other	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	42.92	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 772,560	Site Restoration	06 FISH AND WILDLIFE FACILITIES
<b>CC-3</b>	<b>In-Stream Habitat Features</b>	<b>\$ 312,593</b>								
			Rough Grading (Cut, Fill & Compaction)	3,703.70	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 33,333	Excavation and Site Grading	09 01 CHANNELS
			Rip Rap Class III (2 foot dia, 500 lbs)	3,703.70	C.Y.	Misc. Construction - 24" Riprap	\$ 70	\$ 259,259	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Willow Clippings	200.00	EA	Planting - Willow Clippings	\$ 100	\$ 20,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
<b>CC-5</b>	<b>Non-Native Aquatic Species Management</b>	<b>\$ 280,000</b>								
			Non-Native Aquatic Species Management	5.00	YR	Species Removal - Non-Native Aquatic	\$ 56,000	\$ 280,000	All Other	06 FISH AND WILDLIFE FACILITIES
<b>CC-6</b>	<b>Feral Pig Management</b>	<b>\$ 301,665</b>								
			Feral Pigs Management	5.00	YR	Species Removal - Feral Pig	\$ 60,333	\$ 301,665	All Other	06 FISH AND WILDLIFE FACILITIES
<b>CC-8</b>	<b>Cow Bird Trapping</b>	<b>\$ 278,250</b>								
			Cow Bird Trapping	5.00	YR	Species Remove - Cow Bird	\$ 55,650	\$ 278,250	All Other	06 FISH AND WILDLIFE FACILITIES

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
MC-1	Invasive Plant Management	\$ 966,190								
			Riparian Edge Management	3.82	AC	Planting - Landscape Maintenance	\$ 10,000	\$ 38,158	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Forrest	7.40	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 70,324	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	7.40	AC	Planting - Riparian Scrub	\$ 8,500	\$ 62,921	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Transitional Scrub	7.40	AC	Planting - Transitional Scrub	\$ 8,500	\$ 62,921	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	31.22	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 43,708	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	28.00	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 294,000	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	1,539.02	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 13,851	Excavation and Site Grading	09 01 CHANNELS
			Decomposed Granite	769.51	C.Y.	Misc. Construction - DG Maintenance Road	\$ 95	\$ 73,104	All Other	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	14.81	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 266,490	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			HydroSeeding	7.40	AC	Planting - Hydro Seeding	\$ 5,500	\$ 40,714	Site Restoration	06 FISH AND WILDLIFE FACILITIES
MC-2	Non-Native Aquatic Species Management	\$ 200,000								
			Non-Native Aquatic Species Management	5.00	YR	Species Removal - Non-Native Aquatic	\$ 40,000	\$ 200,000	All Other	06 FISH AND WILDLIFE FACILITIES
MC-3	Feral Pig Management	\$ 301,665								
			Feral Pigs Management	5.00	YR	Species Removal - Feral Pig	\$ 60,333	\$ 301,665	All Other	06 FISH AND WILDLIFE FACILITIES
MC-5	Cow Bird Trapping	\$ 278,250								
			Cow Bird Trapping	5.00	YR	Species Remove - Cow Bird	\$ 55,650	\$ 278,250	All Other	06 FISH AND WILDLIFE FACILITIES
MC-7	Native Plantings	\$ 461,797								
			Planting Riparian Forrest	14.00	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 133,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	11.19	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 15,661	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	6.02	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 63,247	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	27,765.47	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 249,889	Excavation and Site Grading	09 01 CHANNELS

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
SD-2	In-Stream Habitat Features	\$ 5,498,018								
			Clearing and Grubbing (Light)	3.76	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 5,257	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	3.76	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 39,428	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	13,333.33	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 120,000	Excavation and Site Grading	09 01 CHANNELS
			Derrick Stone (3 foot dia, 3,000 lbs)	26,666.67	C.Y.	Misc. Construction - Derrick Stone	\$ 200	\$ 5,333,333	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
SD-3	Invasive Plant Management	\$ 358,100								
			Planting Riparian Forrest	5.63	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 53,438	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	5.63	AC	Planting - Riparian Scrub	\$ 8,500	\$ 47,813	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Transitional Scrub	5.63	AC	Planting - Transitional Scrub	\$ 8,500	\$ 47,813	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	9.00	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 12,600	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	5.00	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 52,500	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	3.50	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 63,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			HydroSeeding	5.63	AC	Planting - Hydro Seeding	\$ 5,500	\$ 30,938	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Willow Clippings	500.00	EA	Planting - Willow Clippings	\$ 100	\$ 50,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
SD-4	Non-Native Aquatic Species Management	\$ 480,000								
			Non-Native Aquatic Species Management	5.00	YR	Species Removal - Non-Native Aquatic	\$ 96,000	\$ 480,000	All Other	06 FISH AND WILDLIFE FACILITIES
SU-1A	Sediment Management	\$ 42,470,847								
			Invasive Plant Management (Small Scale)	39.68	AC	Clearing - Light Vegetation, By Hand	\$ 8,900	\$ 353,188	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Invasive Plant Management (Large Scale)	39.68	AC	Clearing - Medium Vegetation	\$ 2,200	\$ 87,305	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Forrest	128.46	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 1,220,370	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	230.00	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 322,000	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	299.12	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 3,140,760	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
			Rough Grading (Cut, Fill & Compaction)	2,395,395.00	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 21,558,555	Excavation and Site Grading	09 01 CHANNELS
			Grouted Stone	31,296.00	C.Y.	Misc. Construction - Grouted Stone (Grout Plus Riprap Class II)	\$ 160	\$ 5,007,360	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Derrick Stone (3 foot dia, 3,000 lbs)	13,372.00	C.Y.	Misc. Construction - Derrick Stone	\$ 200	\$ 2,674,400	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Reinforced Concrete	833.00	C.Y.	Misc. Construction - Concrete Pad for Erosion Control	\$ 650	\$ 541,450	All Other	06 FISH AND WILDLIFE FACILITIES
			RCP 48"	1,200.00	L.F.	Culvert - 48" RCP	\$ 330	\$ 395,640	All Other	06 FISH AND WILDLIFE FACILITIES
			Stormdrain Inlet and Outlet	1.00	LS	Culvert - Inlet & Outlet	\$ 42,000	\$ 42,000	All Other	06 FISH AND WILDLIFE FACILITIES
			Decomposed Granite	18,132.00	C.Y.	Misc. Construction - DG Maintenance Road	\$ 95	\$ 1,722,540	All Other	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	154.88	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 2,787,840	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			HydroSeeding	154.88	AC	Planting - Hydro Seeding	\$ 5,500	\$ 851,840	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Willow Clippings	4,500.00	EA	Planting - Willow Clippings	\$ 100	\$ 450,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Sediment Transport System	5,200.00	LF	Sediment Transport System - Downstream of Prado Dam (24" Pipe)	\$ 253	\$ 1,315,600	Sediment Re-Entrainment System	13 PUMPING PLANT
SU-2	Invasive Plant Management	\$ 3,306,000								
			Planting Riparian Forrest	31.00	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 294,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	31.00	AC	Planting - Riparian Scrub	\$ 8,500	\$ 263,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Transitional Scrub	31.00	AC	Planting - Transitional Scrub	\$ 8,500	\$ 263,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	160.00	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 224,000	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	88.00	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 924,000	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	62.00	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 1,116,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			HydroSeeding	31.00	AC	Planting - Hydro Seeding	\$ 5,500	\$ 170,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Willow Clippings	500.00	EA	Planting - Willow Clippings	\$ 100	\$ 50,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
SU-3	Riparian Edge Management	\$ 1,072,239								
			Riparian Edge Management	44.49	AC	Planting - Landscape Maintenance	\$ 10,000	\$ 444,912	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Forrest	6.67	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 63,400	Site Restoration	06 FISH AND WILDLIFE FACILITIES

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
			Planting Riparian Scrub	11.12	AC	Planting - Riparian Scrub	\$ 8,500	\$ 94,544	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	44.49	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 62,288	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Finish Grading	11.12	AC	Earthwork - Re-Grade Site	\$ 600	\$ 6,674	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Temporary Irrigation	22.25	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 400,421	Site Restoration	06 FISH AND WILDLIFE FACILITIES
SU-4	Feral Pig Management	\$ 301,665								
			Feral Pigs Management	5.00	YR	Species Removal - Feral Pig	\$ 60,333	\$ 301,665	All Other	06 FISH AND WILDLIFE FACILITIES
SU-5	In-Stream Habitat Features	\$ 1,951,852								
			Rough Grading (Cut, Fill & Compaction)	24,074.07	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 216,667	Excavation and Site Grading	09 01 CHANNELS
			Rip Rap Class III (2 foot dia, 500 lbs)	24,074.07	C.Y.	Misc. Construction - 24" Riprap	\$ 70	\$ 1,685,185	Instream Habitat Feature	06 FISH AND WILDLIFE FACILITIES
			Willow Clippings	500.00	EA	Planting - Willow Clippings	\$ 100	\$ 50,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
SU-6	Non-Native Aquatic Species Management	\$ 400,000								
			Non-Native Aquatic Species Management	5.00	YR	Species Removal - Non-Native Aquatic	\$ 80,000	\$ 400,000	All Other	06 FISH AND WILDLIFE FACILITIES
SU-7	Cow Bird Trapping	\$ 278,250								
			Cow Bird Trapping	5.00	YR	Species Remove - Cow Bird	\$ 55,650	\$ 278,250	All Other	06 FISH AND WILDLIFE FACILITIES
SU-8	Native Plantings	\$ 976,826								
			Planting Riparian Forrest	9.00	AC	Planting - Riparian Edge Forrest	\$ 9,500	\$ 85,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Riparian Scrub	9.00	AC	Planting - Riparian Scrub	\$ 8,500	\$ 76,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Planting Transitional Scrub	5.00	AC	Planting - Transitional Scrub	\$ 8,500	\$ 42,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	41.10	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 57,540	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	33,154.00	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 298,386	Excavation and Site Grading	09 01 CHANNELS
			Temporary Irrigation	20.55	AC	Planting - Temporary Irrigation	\$ 18,000	\$ 369,900	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			HydroSeeding	3.00	AC	Planting - Hydro Seeding	\$ 5,500	\$ 16,500	Site Restoration	06 FISH AND WILDLIFE FACILITIES

**Detailed Measure Costs - Construction**

Measure ID	Measure Name	Construction Measure Cost	Measure Component	Quantity	UOM	Unit Price Description	Unit Price	Sub Total	ACRA Category	TCPS Category
			Willow Clippings	300.00	EA	Planting - Willow Clippings	\$ 100	\$ 30,000	Site Restoration	06 FISH AND WILDLIFE FACILITIES
WC-1	Water Conservation with incidental sediment removal	\$ 1,550,534								
			Riparian Edge Management	4.59	AC	Planting - Landscape Maintenance	\$ 10,000	\$ 45,914	Site Restoration	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Light)	31.09	AC	Clearing - Light Vegetation, With Heavy Equipment	\$ 1,400	\$ 43,528	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Clearing and Grubbing (Heavy)	7.63	AC	Clearing - Grubbing and Clearing Heavy Vegetation	\$ 10,500	\$ 80,115	Vegetaion Removal	06 FISH AND WILDLIFE FACILITIES
			Rough Grading (Cut, Fill & Compaction)	137,637.96	C.Y.	Earthwork - Excavate and Place Material	\$ 9	\$ 1,238,742	Excavation and Site Grading	09 01 CHANNELS
			Decomposed Granite	1,497.22	C.Y.	Misc. Construction - DG Maintenance Road	\$ 95	\$ 142,236	All Other	06 FISH AND WILDLIFE FACILITIES

## **Attachment 3 – Abbreviated Cost Risk Analysis**

**Abbreviated Risk Analysis**

Project (greater than \$40M): **Prado Basin Ecosystem Restoration**  
 Project Development Stage/Alternative: **Feasibility (Alternatives)**  
 Risk Category: **Moderate Risk: Typical Project Construction Type**

Alternative: **CEICA Plan 9**

Meeting Date:

Total Estimated Construction Contract Cost = \$ **15,512,886**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>		<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ -		0.00%	\$ -	\$ -
1	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Vegetation Removal</b>	\$ <b>3,109,012</b>		40.63%	\$ 1,263,315	\$ 4,372,327
2	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Site Restoration</b>	\$ <b>8,113,211</b>		48.33%	\$ 3,921,123	\$ 12,034,334
3	<b>09 01 CHANNELS</b>	<b>Excavation and Site Grading</b>	\$ <b>2,761,163</b>		54.18%	\$ 1,495,917	\$ 4,257,080
12	All Other	<b>Remaining Construction Items</b>	\$ <b>1,529,500</b>	10.9%	37.58%	\$ 574,772	\$ 2,104,272
13	30 PLANNING, ENGINEERING, AND DESIGN	<b>Planning, Engineering, &amp; Design</b>	\$ <b>3,878,222</b>		14.70%	\$ 569,949	\$ 4,448,170
14	31 CONSTRUCTION MANAGEMENT	<b>Construction Management</b>	\$ <b>1,085,902</b>		31.37%	\$ 340,643	\$ 1,426,545
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					\$ -	

<b>Totals</b>							
	Real Estate	\$ -		0.00%	\$ -	\$ -	
	Total Construction Estimate	\$ 15,512,886		46.77%	\$ 7,255,127	\$ 22,768,013	
	Total Planning, Engineering & Design	\$ 3,878,222		14.70%	\$ 569,949	\$ 4,448,170	
	Total Construction Management	\$ 1,085,902		31.37%	\$ 340,643	\$ 1,426,545	
	<b>Total Excluding Real Estate</b>	<b>\$ 20,477,010</b>		<b>40%</b>	<b>\$ 8,165,719</b>	<b>\$ 28,642,728</b>	

Confidence Level Range Estimate (\$000's)	Base	50%	80%
		\$20,477k	\$25,377k

\* 50% based on base is at 5% CL.

<b>Fixed Dollar Risk Add:</b> (Allows for additional risk to be added to the risk analysis. Must include justification. Does not allocate to Real Estate.	
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**Prado Basin Ecosystem Restoration CEICA Plan 9**

Feasibility (Alternatives)  
Abbreviated Risk Analysis

Meeting Date: 0-Jan-00

		Risk Level				
Very Likely		2	3	4	5	5
Likely		1	2	3	4	5
Possible		0	1	2	3	4
Unlikely		0	0	1	2	3
		Negligible	Marginal	Moderate	Significant	Critical

**Risk Register**

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
<b>Project Management &amp; Scope Growth</b>						<b>75%</b>
PS-1	Vegetation Removal		Limited opportunities for scope growth. The working areas are well defined and the current type of vegetation to be removed is based on ground and aerial surveys. Similar work is routinely done within the project area on a regular basis, either for other construction projects or typical maintenance operations. Current areas of work are considered conservative and unlikely to increase. Likelihood - It is possible the areas for removal may increase if additional arundo ( a local invasive species) is found Impact - A large change in area to be removed, or type of vegetation to be removed, is not anticipated since the PDT is familiar with the basin and aerial surveys used to develop the current measures is less than two years old.	Moderate	Possible	2
PS-2	Site Restoration		Limited opportunities for scope growth. Similar restoration work has been done for recent projects within the project area that are located downstream of Prado Dam. Current areas of work are based on the clearing and grubbing areas and are considered conservative, thus unlikely to increase. Current planting and irrigation requirements could change during final design. Water sources for irrigation have not been identified and may require establishment of small wells. Likelihood - changes to scope are not anticipated but small wells could be required for the temporary irrigation systems Impact - Temporary irrigation is a large portion of the cost for site restoration and any change growth in scope will lead to a growth in cost; however, large changes in the scope are not anticipated because the extent of the irrigation requirements is considered conservative.	Moderate	Possible	2
PS-3	Excavation and Site Grading	Dewatering/ diversion and control of water HTRW Buried debris within Prado Basin Used topo from 2008	HTRW is of limited concern since the work is in a federal basin that is regularly monitored. The material at the stockpile site may need limited processing prior to placement, but this has not been considered in the current measure. There is a risk of finding buried debris within the project site.. Current alternatives rely on topo from 2008 Likelihood - There is a chance these concerns could lead to scope growth Impact - the concerns are not anticipated to lead to significant scope growth of the excavation required to build the site restoration features.	Moderate	Possible	2
PS-12	Remaining Construction Items		Likelihood - Remaining construction includes access roads and construction of a single culvert. There is a chance that additional feet of access road will be required if there is an adjustment to the alignment. The length and size of the culvert could change based on the final hydraulic design of the structure. Impact - The access road and culvert are minor features of the project and any change in scope should have a marginal impact of construction costs.	Marginal	Possible	1
PS-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Possible	0
PS-14	Construction Management		Any growth in the scope of work will extend the construction duration of the project and require additional construction management funds.	Moderate	Possible	2

<b>Acquisition Strategy</b>				<b>Maximum Project Growth</b>		<b>30%</b>
AS-1	Vegetation Removal	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-2	Site Restoration	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-3	Excavation and Site Grading	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - The team anticipates the project will be phased once construction begins Impact - The size of the project and nature of the work means there could be numerous phases during construction that will require multiple sub contractors and be eligible for multiple contracting methods.	Moderate	Likely	3
AS-12	Remaining Construction Items	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Likely	3
AS-13	Planning, Engineering, & Design	No Contracting Plan Likely to be phased into smaller projects	Additional PED funds will be required as the number of phases increase. There is no contracting plan in place so the number of phases is unknown.	Moderate	Likely	3
AS-14	Construction Management	No Contracting Plan Likely to be phased into smaller projects	Additional Construction Management funds will be required as the number of phases increase. There is no contracting plan in place so the number of phases is unknown.	Moderate	Likely	3

<b>Construction Elements</b>				<b>Maximum Project Growth</b>		<b>25%</b>
CON-1	Vegetation Removal		Minimum concern with regards to construction. Effort does not require special equipment., relies on well established existing process and is similar to work already being done at other projects and as part of routine O&M.	Marginal	Unlikely	0
CE-2	Site Restoration		Minimum concern with regards to construction. Effort does not require special equipment., relies on well established existing process and is similar to work that has been completed on other projects within the study area.	Marginal	Unlikely	0
CE-3	Excavation and Site Grading	Diversion and control of water	Standard construction, all elements have been built at other projects within the study area. Likelihood - Additional diversion and control of water may be necessary during construction of restoration features within the stream bed. Impact -Construction will be phased to minimize the need to divert water, but if additional diversion structures are needed it is anticipated that they will not be significant in size. Due to the limited depth of the channel, significant dewatering is not anticipated.	Moderate	Possible	2
CE-12	Remaining Construction Items		Minimum concern with regards to construction. Effort does not require special equipment., relies on well established existing process and is similar to work that has been completed on other projects within the study area.	Marginal	Unlikely	0
CE-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
CE-14	Construction Management	Diversion and control of water	There is a change that additional PED funds will be necessary to address any modifications that require additional diversion and control of flows during construction.	Marginal	Possible	1
<b>Specialty Construction or Fabrication</b>				<b>Maximum Project Growth</b>		<b>65%</b>
SC-1	Vegetation Removal		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-2	Site Restoration		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-3	Excavation and Site Grading		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-12	Remaining Construction Items		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-13	Planning, Engineering, & Design		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-14	Construction Management		No specialty fabrication or construction will be required.	Negligible	Unlikely	0

<b>Technical Design &amp; Quantities</b>				<b>Maximum Project Growth</b>		<b>30%</b>
T-1	Vegetation Removal		No concern over the quantities. Current quantities are based on recent areal photography and standard methods were used to calculate the acerages of the types of vegetatoin to be removed.	Negligible	Unlikely	0
T-2	Site Restoration	Irrigation design	Likelihood - There is no design in place for the temporary irrigation systems. Current costs are based on data take from other projectes within the study area. The systems may need to be more robust then necessary and have temporary wells to ensure the vegetation can establish. Impact - The cost of the irrigatoin could grow substantially during final design and is a key cost for all site restoration work.	Significant	Possible	3
T-3	Excavation and Site Grading	Older topography	Current earthwork quantities are based on a 3D model and 2008 topography. Likelihood - There is a chance newer topography will highlight the need for additional excavation. Impact - Changes in earthwork quantities due to newer topography are not anticipated to be significant becuase the proposed earth work is to ensure positive drainage in restore areas and fill any hols left from clearing and grubing operations. Final grades can be adjusted as neccessary during the final design to limit the changes in excavation quantities	Marginal	Likely	2
T-12	Remaining Construction Items	Limite design data		Moderate	Likely	3
T-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
T-14	Construction Management		Current construction estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum construction management funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0

<b>Cost Estimate Assumptions</b>				<b>Maximum Project Growth</b>		<b>35%</b>
EST-1	Vegetation Removal	Material disposal	Current assumption is that all material will be chipped and then used within the basin as ground cover or mulch. Likelihood - The current assumption is reasonable based on input from the local sponsor, but there is a chance there will not be a need for the material at the time of construction which will then force the material to be hauled to a disposal location Impact - Additional trucking and disposal fees could be significant based on the amount of material that would be hauled away for disposal.	Significant	Possible	3
EST-2	Site Restoration	Current prices are estimates from PDT members based on recent project within the study area	Current prices are estimates provided by PDT members based on costs incurred during other projects within the study area. Likelihood - It is likely that prices will change once more detailed estimates for project specific features are developed. Impact - Current estimates are considered conservative so a large increase in price as more information becomes available is not anticipated.	Moderate	Likely	3
EST-3	Excavation and Site Grading	Material encountered during excavation Haul distances	Current estimate is based on building a crew in MI that assumes all excavated material is hauled to a site within 3,000 Ft of where it was excavated from and placed with minimal compaction. This haul distance is not based on balancing cut/fill numbers and could increase for some areas of excavation. It is not anticipated that the haul distance would increase significantly. Current estimate assumes all material being excavated is sand with a minimum amount of gravel. There is a chance there are lenses of other types of material within the excavated area. Likelihood - it is likely not all the material will not be sand and haul distances may slightly increase once a more detailed cost estimate is developed. Impact - Haul distances are not anticipated to increase significantly so the number of trucks necessary will not change by much. Based on previous projects within the project area, it is unlikely that crews will encounter large amounts of material that vary significantly from the assumed sand with a minimum amount of gravel.	Moderate	Very LIKELY	4
EST-12	Remaining Construction Items			Moderate	Likely	3
EST-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
EST-14	Construction Management		Current construction estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum construction management funds.	Negligible	Unlikely	0

External Project Risks				Maximum Project Growth	40%	
EX-1	Vegetation Removal	Fire/drought could reduce the need for clearing Wet year increases the density of vegetation / arundo that has to be removed.	Weather could impact clearing requirements. If there is a fire with then study area then the amount of vegetation that needs to be cleared could be reduced significantly. A series of wet winters could increase the density of the vegetation that needs to be removed. If the region is subject to a drought similar to past droughts then a lack of water could lead to a decrease in vegetation. Likelihood - Fire, drought, and wet years are not regular occurrences within the study area buy will happen in the future. Impact - Drought and fire would lead to a decrease in vegetation while a wet year could lead to a moderate increase in vegetation density.	Moderate	Possible	2
EX-2	Site Restoration	Fire destroys vegetation	Likelihood - Fires not regular occurrences within the study area but will happen in the future. Impact - A fire within the basin could generate the need for additional restoration efforts to ensure the project fulfills the ecosystem restoration mission.	Moderate	Possible	2
EX-3	Excavation and Site Grading	Sediment Inflow Large event damaging channel Large pool in the basin could delay construction.	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin and high flows could damage constructed features.	Significant	Possible	3
EX-12	Remaining Construction Items			Moderate	Possible	2
EX-13	Planning, Engineering, & Design		Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin.	Negligible	Unlikely	0
EX-14	Construction Management	Wet year limits construction efforts Sediment inflow may increase construction duration	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. A wet year could also lead to a large pool within the reservoir that could inundate construction activities. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin. A large pool within the basin could delay or even extend a construction period.	Significant	Possible	3

**Prado Basin Ecosystem Restoration CEICA Plan 9**  
 Feasibility (Alternatives)  
 Abbreviated Risk Analysis

**Risk Evaluation**

<u>WBS</u>	<u>Potential Risk Areas</u>	Project Management & Scope Growth	Acquisition Strategy	Construction Elements	Specialty Construction or Fabrication	Technical Design & Quantities	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
01 LANDS AND DAMAGES	Real Estate								\$0
06 FISH AND WILDLIFE FACILITIES	Vegetation Removal	2	4	0	0	0	3	2	\$3,109
06 FISH AND WILDLIFE FACILITIES	Site Restoration	2	4	0	0	3	3	2	\$8,113
09 01 CHANNELS	Excavation and Site Grading	2	3	2	0	2	4	3	\$2,761
0	0	2	3	0	0	0	3	2	\$0
0	0	2	3	0	0	3	3	2	\$0
All Other	Remaining Construction Items	1	3	0	0	3	3	2	\$1,530
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	0	3	0	0	0	0	0	\$3,878
31 CONSTRUCTION MANAGEMENT	Construction Management	2	3	1	0	0	0	3	\$1,086

**\$20,477**

<b>Risk</b>	\$ 884	\$ 2,417	\$ 1,554	\$ -	\$ 850	\$ 1,551	\$ 910	<b>\$8,166</b>
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<b>Fixed Dollar Risk Allocation</b>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	<b>\$0</b>
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Risk	\$ 884	\$ 2,417	\$ 1,554	\$ -	\$ 850	\$ 1,551	\$ 910	<b>\$8,166</b>
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**Total** **\$28,643**

**Abbreviated Risk Analysis**

Project (greater than \$40M): **Prado Basin Ecosystem Restoration**  
 Project Development Stage/Alternative: **Feasibility (Alternatives)**  
 Risk Category: **Moderate Risk: Typical Project Construction Type**

Alternative: **CEICA Plan 11**

Meeting Date:

Total Estimated Construction Contract Cost = \$ **63,403,456**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ -	0.00%	\$ -	\$ -
1	<b>09 01 CHANNELS</b>	<b>Excavation and Site Grading</b>	\$ <b>23,200,976</b>	41.13%	\$ 9,543,468	\$ 32,744,444
2	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Instream Habitat Features</b>	\$ <b>13,267,715</b>	73.58%	\$ 9,762,804	\$ 23,030,519
3	<b>13 PUMPING PLANT</b>	<b>Sediment Re-Entrainment System</b>	\$ <b>1,315,600</b>	93.10%	\$ 1,224,875	\$ 2,540,475
4	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Vegetation Removal</b>	\$ <b>6,995,594</b>	40.63%	\$ 2,842,587	\$ 9,838,181
5	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Site Restoration</b>	\$ <b>14,387,299</b>	48.33%	\$ 6,953,396	\$ 21,340,695
12	All Other	<b>Remaining Construction Items</b>	\$ <b>4,236,272</b>	7.2%	\$ 2,984,787	\$ 7,221,059
13	30 PLANNING, ENGINEERING, AND DESIGN	<b>Planning, Engineering, &amp; Design</b>	\$ <b>15,850,864</b>	14.70%	\$ 2,329,465	\$ 18,180,329
14	31 CONSTRUCTION MANAGEMENT	<b>Construction Management</b>	\$ <b>4,438,242</b>	31.37%	\$ 1,392,260	\$ 5,830,502
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					\$ -

<b>Totals</b>						
	Real Estate	\$ -		0.00%	\$ -	\$ -
	Total Construction Estimate	\$ 63,403,456		52.54%	\$ 33,311,917	\$ 96,715,373
	Total Planning, Engineering & Design	\$ 15,850,864		14.70%	\$ 2,329,465	\$ 18,180,329
	Total Construction Management	\$ 4,438,242		31.37%	\$ 1,392,260	\$ 5,830,502
	<b>Total Excluding Real Estate</b>	<b>\$ 83,692,562</b>		<b>44%</b>	<b>\$ 37,033,641</b>	<b>\$ 120,726,203</b>
	<b>Confidence Level Range Estimate (\$000's)</b>		<b>Base</b>		<b>50%</b>	<b>80%</b>
			\$83,693k		\$105,913k	\$120,726k

\* 50% based on base is at 5% CL.

**Fixed Dollar Risk Add:** (Allows for additional risk to be added to the risk analysis. Must include justification. Does not allocate to Real Estate.)

**Prado Basin Ecosystem Restoration CEICA Plan 11**

Feasibility (Alternatives)  
Abbreviated Risk Analysis

Meeting Date: 0-Jan-00

Risk Level					
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Moderate	Significant	Critical

**Risk Register**

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level	
<b>Project Management &amp; Scope Growth</b>						<b>Maximum Project Growth</b>	<b>75%</b>
PS-1	Excavation and Site Grading	Dewatering/ diversion and control of water Inflow of sediment during construction HTRW Need for material processing at stockpile sites Buried debris within Prado Basin Used topo from 2008	Current assumption is that portions of the small trap will be built in a sequence that minimizes the needs to divert water. Dewatering is not expected, but may be required based on the time of year of construction. A large inflow of sediment could occur prior to construction and require the removal of additional sediment. HTRW is of limited concern since the work is in a federal basin that is regularly monitored. The material at the stockpile site may need limited processing prior to placement, but this has not been considered in the current measure. There is a risk of finding buried debris within the project site.. Current alternatives rely on topo from 2008 Likelihood - There is a chance these concerns could lead to scope growth Impact - the concerns are not anticipated to lead to significant scope growth of the earthwork required to build the small trap channel.	Moderate	Possible	2	
PS-2	Instream Habitat Features	Limited design information Still need scour analysis to finalize design of in stream features	Likelihood - Due to the limited information, and preliminary nature of design, it is likely that the design for the scope of the grade control structures and the wildlife crossing will change. Impact - Once the final scour analysis is completed the required scope of the grade control structures could grow significantly.	Significant	Likely	4	
PS-3	Sediment Re-Entrainment System	Limited Design information Two big questions - will the system be permanent and will it pass under or through the existing embankment / future spillway improvements	Current system is based on a preliminary design and diameter of pipe and pumps may change based on final design. Design includes widening maintenance road but does not consider any impacts to existing embankment. The required capacity of the system is unlikely to change due to known limits to the quantity of reentrained sediment in the downstream portions of the channel. Current reentrainment is based on hydraulic models. The alignment is unlikely to change, and it does change it may get shorter. Major concern is if the system will go through the existing embankment or under the future spillway improvements. This is being considered as a way to possible save on long-term pumping costs. Another key question is if the system along the maintenance road will be permanent or temporary and placed by a contractor as necessary. Likelihood - The design will change as it is finalized and it is likely the scope of the entrainment system may grow as additional requirements for the system become known. Impact - There could be significant impacts to the scope if the system goes through the existing embankment or under the future spillway improvements.	Significant	Likely	4	
PS-4	Vegetation Removal		Limited opportunities for scope growth. The working areas are well defined and the current type of vegetation to be removed is based on ground and aerial surveys. Similar work is routinely done within the project area on a regular basis, either for other construction projects or typical maintenance operations. Current areas of work are considered conservative and unlikely to increase. Likelihood - It is possible the areas for removal may increase if additional arundo ( a local invasive species) is found Impact - A large change in area to be removed, or type of vegetation to be removed, is not anticipated since the PDT is familiar with the basin and aerial surveys used to develop the current measures is less than two years old.	Moderate	Possible	2	
PS-5	Site Restoration		Limited opportunities for scope growth. Similar restoration work has been done for recent projects within the project area that are located downstream of Prado Dam. Current areas of work are based on the clearing and grubbing areas and are considered conservative, thus unlikely to increase. Current planting and irrigation requirements could change during final design. Water sources for irrigation have not been identified and may require establishment of small wells. Likelihood - changes to scope are not anticipated but small wells could be required for the temporary irrigation systems Impact- Temporary irrigation is a large portion of the cost for site restoration and any change growth in scope will lead to a growth in cost; however, large changes in the scope are not anticipated because the extent of the irrigation requirements is considered conservative.	Moderate	Possible	2	
PS-12	Remaining Construction Items	Future road improvements at the wildlife crossing sites could significantly impact the scope of the wildlife crossing.	Wildlife crossing - design needs to be finalized. How the design will interface with future road improvements is not well understood and could change significantly once the road improvements are finalized. Likelihood - Due to the limited information, and preliminary nature of design, it is likely that the design for the scope of the wildlife crossing will change. Impact - The scope of the crossing could grow significantly once the final design is complete	Significant	Likely	4	

PS-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Possible	0
PS-14	Construction Management		Any growth in the scope of work will extend the construction duration of the project and require additional construction management funds.	Moderate	Possible	2

<b>Acquisition Strategy</b>				<b>Maximum Project Growth</b>		<b>30%</b>
AS-1	Excavation and Site Grading	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - The team anticipates the project will be phased once construction begins Impact - The size of the project and nature of the work means there could be numerous phases during construction that will require multiple sub contractors and be eligible for multiple contracting methods.	Moderate	Likely	3
AS-2	Instream Habitat Features	No Contracting Plan Sub contractors will be likely be required	Work will likely be done by a sub as part of a larger contract. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-3	Sediment Re-Entrainment System	No Contracting Plan Sub contractors will be likely be required	Work will be done by a single contract. Similar work has not been completed in the area so competition is not known. Sub contractors will likely be required for different aspects of the work. Likelihood - This work cannot be phased and will be completed under one contract but a similar system has not been installed within the project area. Subcontractors will be required.	Moderate	Very LIKELY	4
AS-4	Vegetagion Removal	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-5	Site Restoration	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-12	Remaining Construction Items	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Likely	3
AS-13	Planning, Engineering, & Design	No Contracting Plan Likely to be phased into smaller projects	Additional PED funds will be required as the number of phases increase. There is no contracting plan in place so the number of phases is unknown.	Moderate	Likely	3
AS-14	Construction Management	No Contracting Plan Likely to be phased into smaller projects	Additional Construction Management funds will be required as the number of phases increase. There is no contracting plan in place so the number of phases is unknown.	Moderate	Likely	3

<b>Construction Elements</b>				<b>Maximum Project Growth</b>		<b>25%</b>
CON-1	Excavation and Site Grading	Diversion and control of water Dewatering	Standard construction, all elements have been built at other projects within the study area. Dewatering is a concern, but depths are not deep enough to warrant a significant concern. Diversion channels will most likely not be necessary. Construction phasing will allow other features (wetlands) be used as diversion structures. Likelihood - Additional diversion and control of water may be necessary during construction. Impact -Construction will be phased to minimize the need to divert water, but if additional diversion structures are needed it is anticipated that they will not be significant in size. Due to the limited depth of the channel, significant dewatering is not anticipated.	Moderate	Possible	2
CE-2	Instream Habitat Features	Diversion and control of water Dewatering	Standard construction, all elements have been built at other projects within the study area. Dewatering is a concern, but depths are not deep enough to warrant a significant concern. Diversion channels will most likely not be necessary. Construction phasing will allow other features (wetlands) be used as diversion structures. All stone for construction will come from local quarries that have provided similar stone for projects within the study area. There is a concern that there could be unknown utilities within the road at the Wildlife Crossing locations. Likelihood - Possible - Additional diversion and control of water may be necessary during construction. Additional utility data is needed to complete the design of the Wildlife Crossings. Impact -Moderate- Construction will be phased to minimize the need to divert water, but if additional diversion structures are needed it is anticipated that they will not be significant in size. Due to the limited depth of the channel, significant dewatering is not anticipated.	Moderate	Possible	2
CE-3	Sediment Re-Entrainment System	Limited space for construction (along access road) Construction through existing embankment Construction during spillway improvements	Construction efforts will be limited to along the existing access road. Limited space may impact installation of the pipe line, but not significantly. Final design may require jacking a pipe through the existing levee embankment or under the future raised spillway. Likelihood - It is possible the final design may pass through the existing embankment if there is a long term savings in energy costs (reduced elevation difference means smaller pumps). Impact - If the pipe passes through the existing embankment then there could be numerous challenges during construction in an effort to preserve the integrity of the existing embankment.	Significant	Possible	3
CE-4	Vegetation Removal		Minimum concern with regards to construction. Effort does not require special equipment., relies on well established existing process and is similar to work already being done at other projects and as part of routine O&M.	Marginal	Unlikely	0
CE-5	Site Restoration		Minimum concern with regards to construction. Effort does not require special equipment., relies on well established existing process and is similar to work already being done at other projects and as part of routine O&M.	Marginal	Unlikely	0
CE-12	Remaining Construction Items	Utility crossings within the road at the Wildlife Crossings Diversion and control of water Dewatering	Standard construction, all elements have been built at other projects within the study area. Dewatering is a concern, but depths are not deep enough to warrant a significant concern. Diversion channels will most likely not be necessary. Construction phasing will allow other features (wetlands) be used as diversion structures. There is a concern that there could be unknown utilities within the road at the Wildlife Crossing locations. Likelihood - Possible - Additional diversion and control of water may be necessary during construction. Additional utility data is needed to complete the design of the Wildlife Crossings. Impact -Moderate- Construction will be phased to minimize the need to divert water, but if additional diversion structures are needed it is anticipated that they will not be significant in size. Due to the limited depth of the channel, significant dewatering is not anticipated. Significant utilities (such as trunk lines or fiber optic lines) are not anticipated at the location of the wildlife crossings and any impacted utilities should be small.	Moderate	Possible	2
CE-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
CE-14	Construction Management	Diversion and control of water	There is a change that additional PED funds will be necessary to address any modifications that require additional diversion and control of flows during construction.	Marginal	Possible	1
<b>Specialty Construction or Fabrication</b>				<b>Maximum Project Growth</b>		<b>65%</b>
SC-1	Excavation and Site Grading		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-2	Instream Habitat Features		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-3	Sediment Re-Entrainment System		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-4	Vegetation Removal		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-5	Site Restoration		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-12	Remaining Construction Items		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-13	Planning, Engineering, & Design		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-14	Construction Management		No specialty fabrication or construction will be required.	Negligible	Unlikely	0

<b>Technical Design &amp; Quantities</b>				<b>Maximum Project Growth</b>		<b>30%</b>
T-1	Excavation and Site Grading	Limited hydraulic modeling	Final channel design will require additional hydraulic modeling. Current earthwork quantities are based on a 3D model and 2008 topography. Likelihood - The final channel design will be adjusted based on the final hydraulic model and there is a chance newer topography will highlight the need for additional excavation. Impact - Changes in earthwork quantities due to newer topography and the final hydraulic design are not anticipated to be significant because the current profile of the channel is not dependent on other features and the gradient and depth of channel can be adjusted as necessary to minimize any increases in excavation.	Moderate	Possible	2
T-2	Instream Habitat Features	Limited design data	Likelihood - Additional hydraulic modeling is required to determine the final size and number of grade control structures and the material that will be used for instream habitat features. This additional modeling could indicate a need to increase the number and size of structures within the channels. Impact - Current designs are based on similar features located in other projects within the study area. It is unlikely that the additional hydraulic modeling will lead to a significant increase in the number of grade control structures or significant changes to the current design of instream habitat features.	Moderate	Likely	3
T-3	Sediment Re-Entrapment System	Limited design data	Likelihood - The current entrapment system is only a conceptual design and a more detailed design will be developed later in the study. Impact - If the system passes under the embankment or through the future spill way then the final design will change significantly from what is currently assumed in the cost estimate.	Significant	Likely	4
T-4	Vegetation Removal		No concern over the quantities. Current quantities are based on recent aerial photography and standard methods were used to calculate the averages of the types of vegetation to be removed.	Negligible	Unlikely	0
T-5	Site Restoration	Irrigation design	Likelihood - There is no design in place for the temporary irrigation systems. Current costs are based on data taken from other projects within the study area. The systems may need to be more robust than necessary and have temporary wells to ensure the vegetation can establish. Impact - The cost of the irrigation could grow substantially during final design and is a key cost for all site restoration work.	Significant	Possible	3
T-12	Remaining Construction Items	Limited design data		Moderate	Likely	3
T-13	Planning, Engineering, & Design		Current PED estimate is considered high due to the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
T-14	Construction Management		Current construction estimate is considered high due to the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum construction management funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0

Cost Estimate Assumptions				Maximum Project Growth	35%	
EST-1	Excavation and Site Grading	Material encountered during excavation Haul distances	Current estimate is based on building a crew in mill that assumes all excavated material is hauled to a site within 3,000 Ft of where it was excavated from and placed with minimal compaction. This haul distance is not based on balancing cut/fill numbers and could increase for some areas of excavation. It is not anticipated that the haul distance would increase significantly. Current estimate assumes all material being excavated is sand with a minimum amount of gravel. There is a chance there are lenses of other types of material within the excavated area. Likelihood - it is likely not all the material will not be sand and haul distances may slightly increase once a more detailed cost estimate is developed. Impact - Haul distances are not anticipated to increase significantly so the number of trucks necessary will not change by much. Based on previous projects within the project area, it is unlikely that crews will encounter large amounts of material that vary significantly from the assumed sand with a minimum amount of gravel.	Marginal	Likely	2
EST-2	Instream Habitat Features	Material encountered during excavation Haul distances Unit price based on cost book items Use of parametric data derived from recent projects within the study area	For all earthwork related items, current estimate is based on building a crew in mill that assumes all excavated material is hauled to a site within 3,000 Ft of where it was excavated from and placed with minimal compaction. This haul distance is not based on balancing cut/fill numbers and could increase for some areas of excavation. It is not anticipated that the haul distance would increase significantly. Current estimate assumes all material being excavated is sand with a minimum amount of gravel. There is a chance there are lenses of other types of material within the excavated area. Multiple items rely on either cost book data or parametric data derived from recent projects with the study area. Likelihood - Its likely that costs will change once project feature specific crews are developed and quotes for materials are obtained Impact - A large increase in costs is not anticipated because the parametric data is for very similar work with 2 miles of Prado Basin and the items that rely on cost book items are small improvements that do not rely on large scale production rates. Haul distances are not anticipated to increase significantly so the number of trucks necessary will not change by much. Based on previous projects within the project area, it is unlikely that crews will encounter large amounts of material that vary significantly from the assumed sand with a minimum amount of gravel.	Moderate	Likely	3
EST-3	Sediment Re-Entrainment System	Unit price data	Current unit prices are based on data from an old report prepared by the sponsor Likelihood - It is very likely the unit prices will change once the final design is developed. The data currently is being used due to the limited nature of the current design. Impact - Unit prices are expected to increase, but not significantly. It is anticipated that the more significant changes in cost will be attributed to changes in scope and design.	Moderate	Very LIKELY	4
EST-4	Vegetation Removal	Material disposal	Current assumption is that all material will be chipped and then used within the basin as ground cover or mulch. Likelihood - The current assumption is reasonable based on input from the local sponsor, but there is a chance there will not be a need for the material at the time of construction which will then force the material to be hauled to a disposal location Impact - Additional trucking and disposal fees could be significant based on the amount of material that would be hauled away for disposal.	Significant	Possible	3
EST-5	Site Restoration	Current prices are estimates from PDT members based on recent project within the study area	Current prices are estimates provided by PDT members based on costs incurred during other projects within the study area. Likelihood - It is likely that prices will change once more detailed estimates for project specific features are developed. Impact - Current estimates are considered conservative so a large increase in price as more information becomes available is not anticipated.	Moderate	Likely	3
EST-12	Remaining Construction Items	Material encountered during excavation Haul distances Unit price based on cost book items Use of parametric data derived from recent projects within the study area	For all earthwork related items, current estimate is based on building a crew in mill that assumes all excavated material is hauled to a site within 3,000 Ft of where it was excavated from and placed with minimal compaction. This haul distance is not based on balancing cut/fill numbers and could increase for some areas of excavation. It is not anticipated that the haul distance would increase significantly. Current estimate assumes all material being excavated is sand with a minimum amount of gravel. There is a chance there are lenses of other types of material within the excavated area. Multiple items rely on either cost book data or parametric data derived from recent projects with the study area. Likelihood - Its likely that costs will change once project feature specific crews are developed and quotes for materials are obtained Impact - A large increase in costs is not anticipated because the parametric data is for very similar work with 2 miles of Prado Basin and the items that rely on cost book items are small improvements that do not rely on large scale production rates. Haul distances are not anticipated to increase significantly so the number of trucks necessary will not change by much. Based on previous projects within the project area, it is unlikely that crews will encounter large amounts of material that vary significantly from the assumed sand with a minimum amount of gravel.	Moderate	Likely	3
EST-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
EST-14	Construction Management		Current construction estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum construction management funds while the remaining funds.	Negligible	Unlikely	0

External Project Risks				Maximum Project Growth		40%
EX-1	Excavation and Site Grading	Sediment Inflow Large event damaging channel Large pool in the basin could delay construction.	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin and high flows could damage constructed features.	Significant	Possible	3
EX-2	Instream Habitat Features	Large event may damage channel features or delay construction	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could increase the amount of material that will need to be removed from the basin and high flows could damage constructed features.	Negligible	Unlikely	0
EX-3	Sediment Re-Entrainment System		No external project risks	Negligible	Unlikely	0
EX-4	Vegetation Removal	Fire/drought could reduce the need for clearing Wet year increases the density of vegetation / arundo that has to be removed.	Weather could impact clearing requirements. If there is a fire with then study area then the amount of vegetation that needs to be cleared could be reduced significantly. A series of wet winters could increase the density of the vegetation that needs to be removed. It the region is subject to a drought similar to past droughts then a lack of water could lead to a decrease in vegetation. Likelihood - Fire, drought, and wet years are not regular occurrences within the study area buy will happen in the future. Impact - Drought and fire would lead to a decrease in vegetation while a wet year could lead to a moderate increase in vegetation density.	Moderate	Possible	2
EX-5	Site Restoration	Fire destroys vegetation	Likelihood - Fires not regular occurrences within the study area but will happen in the future. Impact - A fire within the basin could generate the need for additional restoration efforts to ensure the project fulfills the ecosystem restoration mission.	Moderate	Possible	2
EX-12	Remaining Construction Items	Large event may damage channel features or delay construction	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could increase the amount of material that will need to be removed from the basin and high flows could damage constructed features.	Moderate	Possible	2
EX-13	Planning, Engineering, & Design		Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin.	Negligible	Unlikely	0
EX-14	Construction Management	Wet year limits construction efforts Sediment inflow may increase construction duration	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. A wet year could also lead to a large pool within the reservoir that could inundate construction activities. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin. A large pool within the basin could delay or even extend a construction period.	Significant	Possible	3

**Prado Basin Ecosystem Restoration CEICA Plan 11**  
 Feasibility (Alternatives)  
 Abbreviated Risk Analysis

**Risk Evaluation**

<u>WBS</u>	<u>Potential Risk Areas</u>	Project Management & Scope Growth	Acquisition Strategy	Construction Elements	Specialty Construction or Fabrication	Technical Design & Quantities	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
01 LANDS AND DAMAGES	Real Estate								\$0
09 01 CHANNELS	Excavation and Site Grading	2	3	2	0	2	2	3	\$23,201
06 FISH AND WILDLIFE FACILITIES	Instream Habitat Features	4	4	2	0	3	3	0	\$13,268
13 PUMPING PLANT	Sediment Re-Entrainment System	4	4	3	0	4	4	0	\$1,316
06 FISH AND WILDLIFE FACILITIES	Vegetation Removal	2	4	0	0	0	3	2	\$6,996
06 FISH AND WILDLIFE FACILITIES	Site Restoration	2	4	0	0	3	3	2	\$14,387
All Other	Remaining Construction Items	4	3	2	0	3	3	2	\$4,236
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	0	3	0	0	0	0	0	\$15,851
31 CONSTRUCTION MANAGEMENT	Construction Management	2	3	1	0	0	0	3	\$4,438

**\$83,693**

<b>Risk</b>	\$ 8,709	\$ 9,138	\$ 7,509	\$ -	\$ 3,559	\$ 4,471	\$ 3,648	<b>\$37,034</b>
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<b>Fixed Dollar Risk Allocation</b>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	<b>\$0</b>
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Risk	\$ 8,709	\$ 9,138	\$ 7,509	\$ -	\$ 3,559	\$ 4,471	\$ 3,648	<b>\$37,034</b>
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**Total** **\$120,726**

**Abbreviated Risk Analysis**

Project (greater than \$40M): **Prado Basin Ecosystem Restoration**  
 Project Development Stage/Alternative: **Feasibility (Alternatives)**  
 Risk Category: **Moderate Risk: Typical Project Construction Type**

Alternative: **CEICA Plan 14**

Meeting Date:

Total Estimated Construction Contract Cost = \$ **66,740,303**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ -	0.00%	\$ -	\$ -
1	<b>09 01 CHANNELS</b>	<b>Excavation and Site Grading</b>	\$ <b>23,417,643</b>	41.13%	\$ 9,632,591	\$ 33,050,234
2	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Instream Habitat Features</b>	\$ <b>14,952,900</b>	73.58%	\$ 11,002,817	\$ 25,955,717
3	<b>13 PUMPING PLANT</b>	<b>Sediment Re-Entrainment System</b>	\$ <b>1,315,600</b>	93.10%	\$ 1,224,875	\$ 2,540,475
4	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Vegetation Removal</b>	\$ <b>6,995,594</b>	40.63%	\$ 2,842,587	\$ 9,838,181
5	<b>06 FISH AND WILDLIFE FACILITIES</b>	<b>Site Restoration</b>	\$ <b>14,437,299</b>	48.33%	\$ 6,977,561	\$ 21,414,860
12	All Other	<b>Remaining Construction Items</b>	\$ <b>5,621,267</b>	9.2% 77.96%	\$ 4,382,149	\$ 10,003,416
13	30 PLANNING, ENGINEERING, AND DESIGN	<b>Planning, Engineering, &amp; Design</b>	\$ <b>16,685,076</b>	14.70%	\$ 2,452,061	\$ 19,137,137
14	31 CONSTRUCTION MANAGEMENT	<b>Construction Management</b>	\$ <b>4,671,821</b>	31.37%	\$ 1,465,533	\$ 6,137,354
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)				\$ -	

<b>Totals</b>						
	Real Estate	\$ -	0.00%	\$ -	\$ -	\$ -
	Total Construction Estimate	\$ 66,740,303	54.03%	\$ 36,062,580	\$ 102,802,883	
	Total Planning, Engineering & Design	\$ 16,685,076	14.70%	\$ 2,452,061	\$ 19,137,137	
	Total Construction Management	\$ 4,671,821	31.37%	\$ 1,465,533	\$ 6,137,354	
	<b>Total Excluding Real Estate</b>	\$ <b>88,097,200</b>	<b>45%</b>	\$ <b>39,980,174</b>	\$ <b>128,077,374</b>	
	<b>Confidence Level Range Estimate (\$000's)</b>			<b>Base</b>	<b>50%</b>	<b>80%</b>
				\$88,097k	\$112,085k	\$128,077k

\* 50% based on base is at 5% CL.

**Fixed Dollar Risk Add:** (Allows for additional risk to be added to the risk analysis. Must include justification. Does not allocate to Real Estate.)

**Prado Basin Ecosystem Restoration CEICA Plan 14**

Feasibility (Alternatives)  
Abbreviated Risk Analysis

Meeting Date: 0-Jan-00

Risk Level					
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Moderate	Significant	Critical

**Risk Register**

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
<b>Project Management &amp; Scope Growth</b>						<b>75%</b>
PS-1	Excavation and Site Grading	Dewatering/ diversion and control of water Inflow of sediment during construction HTRW Need for material processing at stockpile sites Buried debris within Prado Basin Used topo from 2008	Current assumption is that portions of the small trap will be built in a sequence that minimizes the needs to divert water. Dewatering is not expected, but may be required based on the time of year of construction. A large inflow of sediment could occur prior to construction and require the removal of additional sediment. HTRW is of limited concern since the work is in a federal basin that is regularly monitored. The material at the stockpile site may need limited processing prior to placement, but this has not been considered in the current measure. There is a risk of finding buried debris within the project site.. Current alternatives rely on topo from 2008 Likelihood - There is a chance these concerns could lead to scope growth Impact - the concerns are not anticipated to lead to significant scope growth of the earthwork required to build the small trap channel.	Moderate	Possible	2
PS-2	Instream Habitat Features	Limited design information Still need scour analysis to finalize design of in stream features	Likelihood - Due to the limited information, and preliminary nature of design, it is likely that the design for the scope of the grade control structures and the wildlife crossing will change. Impact - Once the final scour analysis is completed the required scope of the grade control structures could grow significantly.	Significant	Likely	4
PS-3	Sediment Re-Entrainment System	Limited Design information Two big questions - will the system be permanent and will it pass under or through the existing embankment / future spillway improvements	Current system is based on a preliminary design and diameter of pipe and pumps may change based on final design. Design includes widening maintenance road but does not consider any impacts to existing embankment. The required capacity of the system is unlikely to change due to known limits to the quantity of reentrained sediment in the downstream portions of the channel. Current reentrainment is based on hydraulic models. The alignment is unlikely to change, and it does change it may get shorter. Major concern is if the system will go through the existing embankment or under the future spillway improvements. This is being considered as a way to possible save on long-term pumping costs. Another key question is if the system along the maintenance road will be permanent or temporary and placed by a contractor as necessary. Likelihood - The design will change as it is finalized and it is likely the scope of the entrainment system may grow as additional requirements for the system become known. Impact - There could be significant impacts to the scope if the system goes through the existing embankment or under the future spillway improvements.	Significant	Likely	4
PS-4	Vegetation Removal		Limited opportunities for scope growth. The working areas are well defined and the current type of vegetation to be removed is based on ground and aerial surveys. Similar work is routinely done within the project area on a regular basis, either for other construction projects or typical maintenance operations. Current areas of work are considered conservative and unlikely to increase. Likelihood - It is possible the areas for removal may increase if additional arundo ( a local invasive species) is found Impact - A large change in area to be removed, or type of vegetation to be removed, is not anticipated since the PDT is familiar with the basin and aerial surveys used to develop the current measures is less than two years old.	Moderate	Possible	2
PS-5	Site Restoration		Limited opportunities for scope growth. Similar restoration work has been done for recent projects within the project area that are located downstream of Prado Dam. Current areas of work are based on the clearing and grubbing areas and are considered conservative, thus unlikely to increase. Current planting and irrigation requirements could change during final design. Water sources for irrigation have not been identified and may require establishment of small wells. Likelihood - changes to scope are not anticipated but small wells could be required for the temporary irrigation systems Impact- Temporary irrigation is a large portion of the cost for site restoration and any change growth in scope will lead to a growth in cost; however, large changes in the scope are not anticipated because the extent of the irrigation requirements is considered conservative.	Moderate	Possible	2
PS-12	Remaining Construction Items	Limited design information Still need scour analysis to finalize design of in stream features Future road improvements at the wildlife crossing sites could significantly impact the scope of the wildlife crossing.	Wildlife crossing - design needs to be finalized. How the design will interface with future road improvements is not well understood and could change significantly once the road improvements are finalized. Engineered grade control structures - no scour analysis to support number/sizing. Number/size of structures may increase once final scour analysis is completed. Likelihood - Due to the limited information, and preliminary nature of design, it is likely that the design for the scope of the grade control structures and the wildlife crossing will change. Impact - Once the final scour analysis is completed the required scope of the grade control structures could grow significantly.	Significant	Likely	4

PS-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Possible	0
PS-14	Construction Management		Any growth in the scope of work will extend the construction duration of the project and require additional construction management funds.	Moderate	Possible	2

<b>Acquisition Strategy</b>				<b>Maximum Project Growth</b>		<b>30%</b>
AS-1	Excavation and Site Grading	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - The team anticipates the project will be phased once construction begins Impact - The size of the project and nature of the work means there could be numerous phases during construction that will require multiple sub contractors and be eligible for multiple contracting methods.	Moderate	Likely	3
AS-2	Instream Habitat Features	No Contracting Plan Sub contractors will be likely be required	Work will likely be done by a sub as part of a larger contract. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-3	Sediment Re-Entrainment System	No Contracting Plan Sub contractors will be likely be required	Work will be done by a single contract. Similar work has not been completed in the area so competition is not known. Sub contractors will likely be required for different aspects of the work. Likelihood - This work cannot be phased and will be completed under one contract but a similar system has not been installed within the project area. Subcontractors will be required.	Moderate	Very LIKELY	4
AS-4	Vegetation Removal	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-5	Site Restoration	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-12	Remaining Construction Items	No Contracting Plan Likely to be phased into smaller projects Lots of opportunity for small contractors Sub contractors will be likely be required	No contracting plan in place, but project will most likely be phased into smaller contracts awarded over multiple years. 8a or small business will be likely used where reasonable. Sub contractors will be required. Competition is not expected to be an issue since contracts for similar work have had multiple bids per advertisement. Likelihood - It is anticipated that this work will be part of a larger contract and require a subcontractor Impact - Since work like this has been completed before within the project area, it is likely that the contracts will be attract enough bidders to create a competitive bid environment.	Moderate	Very LIKELY	4
AS-13	Planning, Engineering, & Design	No Contracting Plan Likely to be phased into smaller projects	Additional PED funds will be required as the number of phases increase. There is no contracting plan in place so the number of phases is unknown.	Moderate	Likely	3
AS-14	Construction Management	No Contracting Plan Likely to be phased into smaller projects	Additional Construction Management funds will be required as the number of phases increase. There is no contracting plan in place so the number of phases is unknown.	Moderate	Likely	3

Construction Elements				Maximum Project Growth		25%
CON-1	Excavation and Site Grading	Diversion and control of water Dewatering	Standard construction, all elements have been built at other projects within the study area. Dewatering is a concern, but depths are not deep enough to warrant a significant concern. Diversion channels will most likely not be necessary. Construction phasing will allow other features (wetlands) be used as diversion structures. Likelihood - Additional diversion and control of water may be necessary during construction Impact -Construction will be phased to minimize the need to divert water, but if additional diversion structures are needed it is anticipated that they will not be significant in size. Due to the limited depth of the channel, significant dewatering is not anticipated.	Moderate	Possible	2
CE-2	Instream Habitat Features	Diversion and control of water Dewatering	Standard construction, all elements have been built at other projects within the study area. Dewatering is a concern, but depths are not deep enough to warrant a significant concern. Diversion channels will most likely not be necessary. Construction phasing will allow other features (wetlands) be used as diversion structures. All stone for construction will come from local quarries that have provided similar stone for projects within the study area. There is a concern that there could be unknown utilities within the road at the Wildlife Crossing locations. Likelihood - Possible - Additional diversion and control of water may be necessary during construction. Additional utility data is needed to complete the design of the Wildlife Crossings.	Moderate	Possible	2
CE-3	Sediment Re-Entrainment System	Limited space for construction (along access road) Construction through existing embankment Construction during spillway improvements	Construction efforts will be limited to along the existing access road. Limited space may impact installation of the pipe line, but not significantly. Final design may require jacking a pipe through the existing levee embankment or under the future raised spillway. Likelihood - It is possible the final design may pass through the existing embankment if there is a long term savings in energy costs (reduced elevation difference means smaller pumps). Impact - If the pipe passes through the existing embankment then there could be numerous challenges during construction in an effort to preserve the integrity of the existing embankment.	Significant	Possible	3
CE-4	Vegetation Removal		Minimum concern with regards to construction. Effort does not require special equipment., relies on well established existing process and is similar to work already being done at other projects and as part of routine O&M.	Marginal	Unlikely	0
CE-5	Site Restoration		Minimum concern with regards to construction. Effort does not require special equipment., relies on well established existing process and is similar to work already being done at other projects and as part of routine O&M.	Marginal	Unlikely	0
CE-12	Remaining Construction Items	Utility crossings within the road at the Wildlife Crossings Diversion and control of water Dewatering	Standard construction, all elements have been built at other projects within the study area. Dewatering is a concern, but depths are not deep enough to warrant a significant concern. Diversion channels will most likely not be necessary. Construction phasing will allow other features (wetlands) be used as diversion structures. All stone for construction will come from local quarries that have provided similar stone for projects within the study area. There is a concern that there could be unknown utilities within the road at the Wildlife Crossing locations. Likelihood - Possible - Additional diversion and control of water may be necessary during construction. Additional utility data is needed to complete the design of the Wildlife Crossings. Impact -Moderate- Construction will be phased to minimize the need to divert water, but if additional diversion structures are needed it is anticipated that they will not be significant in size. Due to the limited depth of the channel, significant dewatering is not anticipated. Significant utilities (such as trunk lines or fiber optic lines) are not anticipated at the location of the wildlife crossings and any impacted utilities should be small.	Moderate	Possible	2
CE-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
CE-14	Construction Management	Diversion and control of water	There is a change that additional PED funds will be necessary to address any modifications that require additional diversion and control of flows during construction.	Marginal	Possible	1
Specialty Construction or Fabrication				Maximum Project Growth		65%
SC-1	Excavation and Site Grading		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-2	Instream Habitat Features		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-3	Sediment Re-Entrainment System		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-4	Vegetation Removal		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-5	Site Restoration		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-12	Remaining Construction Items		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-13	Planning, Engineering, & Design		No specialty fabrication or construction will be required.	Negligible	Unlikely	0
SC-14	Construction Management		No specialty fabrication or construction will be required.	Negligible	Unlikely	0

<b>Technical Design &amp; Quantities</b>				<b>Maximum Project Growth</b>		<b>30%</b>
T-1	Excavation and Site Grading	Limited hydraulic modeling	Final channel design will require additional hydraulic modeling. Current earthwork quantities are based on a 3D model and 2008 topography. Likelihood - The final channel design will be adjusted based on the final hydraulic model and there is a chance newer topography will highlight the need for additional excavation. Impact - Changes in earthwork quantities due to newer topography and the final hydraulic design are not anticipated to be significant because the current profile of the channel is not dependent on other features and the gradient and depth of channel can be adjusted as necessary to minimize any increases in excavation.	Moderate	Possible	2
T-2	Instream Habitat Features	Limited design data	Likelihood - Additional hydraulic modeling is required to determine the final size and number of grade control structures and the material that will be used for instream habitat features. This additional modeling could indicate a need to increase the number and size of structures within the channels. Impact - Current designs are based on similar features located in other projects within the study area. It is unlikely that the additional hydraulic modeling will lead to a significant increase in the number of grade control structures or significant changes to the current design of instream habitat features.	Moderate	Likely	3
T-3	Sediment Re-Entrainment System	Limited design data	Likelihood - The current entrainment system is only a conceptual design and a more detailed design will be developed later in the study. Impact - If the system passes under the embankment or through the future spill way then the final design will change significantly from what is currently assumed in the cost estimate.	Significant	Likely	4
T-4	Vegetation Removal		No concern over the quantities. Current quantities are based on recent aerial photography and standard methods were used to calculate the averages of the types of vegetation to be removed.	Negligible	Unlikely	0
T-5	Site Restoration	Irrigation design	Likelihood - There is no design in place for the temporary irrigation systems. Current costs are based on data taken from other projects within the study area. The systems may need to be more robust than necessary and have temporary wells to ensure the vegetation can establish. Impact - The cost of the irrigation could grow substantially during final design and is a key cost for all site restoration work.	Significant	Possible	3
T-12	Remaining Construction Items	Limited design data	Likelihood - Additional hydraulic modeling is required to determine the final size and number of grade control structures and the material that will be used for instream habitat features. This additional modeling could indicate a need to increase the number and size of structures within the channels. Impact - Current designs are based on similar features located in other projects within the study area. It is unlikely that the additional hydraulic modeling will lead to a significant increase in the number of grade control structures or significant changes to the current design of instream habitat features.	Moderate	Likely	3
T-13	Planning, Engineering, & Design		Current PED estimate is considered high due to the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
T-14	Construction Management		Current construction estimate is considered high due to the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum construction management funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0

Cost Estimate Assumptions				Maximum Project Growth		35%
EST-1	Excavation and Site Grading	Material encountered during excavation Haul distances	Current estimate is based on building a crew in mill that assumes all excavated material is hauled to a site within 3,000 Ft of where it was excavated from and placed with minimal compaction. This haul distance is not based on balancing cut/fill numbers and could increase for some areas of excavation. It is not anticipated that the haul distance would increase significantly. Current estimate assumes all material being excavated is sand with a minimum amount of gravel. There is a chance there are lenses of other types of material within the excavated area. Likelihood - it is likely not all the material will not be sand and haul distances may slightly increase once a more detailed cost estimate is developed. Impact - Haul distances are not anticipated to increase significantly so the number of trucks necessary will not change by much. Based on previous projects within the project area, it is unlikely that crews will encounter large amounts of material that vary significantly from the assumed sand with a minimum amount of gravel.	Marginal	Likely	2
EST-2	Instream Habitat Features	Material encountered during excavation Haul distances Unit price based on cost book items Use of parametric data derived from recent projects within the study area	For all earthwork related items, current estimate is based on building a crew in mill that assumes all excavated material is hauled to a site within 3,000 Ft of where it was excavated from and placed with minimal compaction. This haul distance is not based on balancing cut/fill numbers and could increase for some areas of excavation. It is not anticipated that the haul distance would increase significantly. Current estimate assumes all material being excavated is sand with a minimum amount of gravel. There is a chance there are lenses of other types of material within the excavated area. Multiple items rely on either cost book data or parametric data derived from recent projects with the study area. Likelihood - Its likely that costs will change once project feature specific crews are developed and quotes for materials are obtained Impact - A large increase in costs is not anticipated because the parametric data is for very similar work with 2 miles of Prado Basin and the items that rely on cost book items are small improvements that do not rely on large scale production rates. Haul distances are not anticipated to increase significantly so the number of trucks necessary will not change by much. Based on previous projects within the project area, it is unlikely that crews will encounter large amounts of material that vary significantly from the assumed sand with a minimum amount of gravel.	Moderate	Likely	3
EST-3	Sediment Re-Entrainment System	Unit price data	Current unit prices are based on data from an old report prepared by the sponsor Likelihood - It is very likely the unit prices will change once the final design is developed. The data currently is being used due to the limited nature of the current design. Impact - Unit prices are expected to increase, but not significantly. It is anticipated that the more significant changes in cost will be attributed to changes in scope and design.	Moderate	Very LIKELY	4
EST-4	Vegetation Removal	Material disposal	Current assumption is that all material will be chipped and then used within the basin as ground cover or mulch. Likelihood - The current assumption is reasonable based on input from the local sponsor, but there is a chance there will not be a need for the material at the time of construction which will then force the material to be hauled to a disposal location Impact - Additional trucking and disposal fees could be significant based on the amount of material that would be hauled away for disposal.	Significant	Possible	3
EST-5	Site Restoration	Current prices are estimates from PDT members based on recent project within the study area	Current prices are estimates provided by PDT members based on costs incurred during other projects within the study area. Likelihood - It is likely that prices will change once more detailed estimates for project specific features are developed. Impact - Current estimates are considered conservative so a large increase in price as more information becomes available is not anticipated.	Moderate	Likely	3
EST-12	Remaining Construction Items	Material encountered during excavation Haul distances Unit price based on cost book items Use of parametric data derived from recent projects within the study area	For all earthwork related items, current estimate is based on building a crew in mill that assumes all excavated material is hauled to a site within 3,000 Ft of where it was excavated from and placed with minimal compaction. This haul distance is not based on balancing cut/fill numbers and could increase for some areas of excavation. It is not anticipated that the haul distance would increase significantly. Current estimate assumes all material being excavated is sand with a minimum amount of gravel. There is a chance there are lenses of other types of material within the excavated area. Multiple items rely on either cost book data or parametric data derived from recent projects with the study area. Likelihood - Its likely that costs will change once project feature specific crews are developed and quotes for materials are obtained Impact - A large increase in costs is not anticipated because the parametric data is for very similar work with 2 miles of Prado Basin and the items that rely on cost book items are small improvements that do not rely on large scale production rates. Haul distances are not anticipated to increase significantly so the number of trucks necessary will not change by much. Based on previous projects within the project area, it is unlikely that crews will encounter large amounts of material that vary significantly from the assumed sand with a minimum amount of gravel.	Moderate	Likely	3
EST-13	Planning, Engineering, & Design		Current PED estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum PED funds while the remaining funds can be used for engineering design.	Negligible	Unlikely	0
EST-14	Construction Management		Current construction estimate is considered high due the large amount of clearing and grubbing that is required. The clearing and grubbing will require minimum construction management funds.	Negligible	Unlikely	0

External Project Risks				Maximum Project Growth		40%
EX-1	Excavation and Site Grading	Sediment Inflow Large event damaging channel Large pool in the basin could delay construction.	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin and high flows could damage constructed features.	Significant	Possible	3
EX-2	Instream Habitat Features	Large event may damage channel features or delay construction	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event.	Negligible	Unlikely	0
EX-3	Sediment Re-Entrainment System		No external project risks	Negligible	Unlikely	0
EX-4	Vegetation Removal	Fire/drought could reduce the need for clearing Wet year increases the density of vegetation / arundo that has to be removed.	Weather could impact clearing requirements. If there is a fire with then study area then the amount of vegetation that needs to be cleared could be reduced significantly. A series of wet winters could increase the density of the vegetation that needs to be removed. If the region is subject to a drought similar to past droughts then a lack of water could lead to a decrease in vegetation. Likelihood - Fire, drought, and wet years are not regular occurrences within the study area buy will happen in the future. Impact - Drought and fire would lead to a decrease in vegetation while a wet year could lead to a moderate increase in vegetation density.	Moderate	Possible	2
EX-5	Site Restoration	Fire destroys vegetation	Likelihood - Fires not regular occurrences within the study area but will happen in the future. Impact - A fire within the basin could generate the need for additional restoration efforts to ensure the project fulfills the ecosystem restoration mission.	Moderate	Possible	2
EX-12	Remaining Construction Items	Large event may damage channel features or delay construction	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could increase the amount of material that will need to be removed from the basin and high flows could damage constructed features.	Moderate	Possible	2
EX-13	Planning, Engineering, & Design		Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin.	Negligible	Unlikely	0
EX-14	Construction Management	Wet year limits construction efforts Sediment inflow may increase construction duration	Likelihood - It is possible a large storm event could bring a significant amount of sediment into the basin and/or damage project features during construction. These large storm events are greater than a 25 year event. A wet year could also lead to a large pool within the reservoir that could inundate construction activities. Impact - Large amounts of sediment have been deposited within the basin after large storm events. Deposits could almost double the amount of material that will need to be removed from the basin. A large pool within the basin could delay or even extend a construction period.	Significant	Possible	3



## **Attachment 4 – Alternatives Total Project Cost Summary**

ALTERNATIVE SUMMARY SHEET PRADO BASIN ECOSYSTEM RESTORATION PRELIMINARY FEASIBILITY COST ESTIMATE - DRAFT - 06/04/2018					PRICE LEVEL 1-Oct-17
	DESCRIPTION	COST	CONTINGENCY %	CONTINGENCY	TOTAL COST
<b>CEICA PLAN 9</b>					
01	Lands and Damages	\$2,309,446	3%	\$72,583	\$2,382,029
02	Relocations - Utilities	\$0	0%	\$0	\$0
06	Fish and Wildlife Facilities	\$12,751,724	47%	\$5,963,981	\$18,715,705
06	Fish and Wildlife Facilities - Monitoring and Adaptive Management	\$5,916,020	47%	\$2,766,923	\$8,682,943
09	Channels & Canals	\$2,761,163	47%	\$1,291,396	\$4,052,559
30	Preconstruction Engineering and Design (PED) - 25%	\$3,878,222	15%	\$570,099	\$4,448,320
31	Construction Management (S&A) - 7%	\$1,085,902	31%	\$340,647	\$1,426,550
	<b>TOTAL PROJECT COST</b>	\$28,702,476		\$11,005,629	\$39,708,104
<b>CEICA PLAN 11</b>					
01	Lands and Damages	\$3,125,025	2%	\$75,700	\$3,200,725
02	Relocations - Utilities	\$3,600,000		\$0	\$3,600,000
06	Fish and Wildlife Facilities	\$38,886,880	53%	\$20,431,167	\$59,318,046
06	Fish and Wildlife Facilities - Monitoring and Adaptive Management	\$9,684,520	53%	\$5,088,247	\$14,772,767
09	Channels & Canals	\$23,200,976	53%	\$12,189,793	\$35,390,769
13	Pumping Plant	\$1,315,600	53%	\$691,216	\$2,006,816
30	Preconstruction Engineering and Design (PED) - 25%	\$15,850,864	15%	\$2,330,077	\$18,180,941
31	Construction Management (S&A) - 7%	\$4,438,242	31%	\$1,392,276	\$5,830,518
	<b>TOTAL PROJECT COST</b>	\$100,102,107		\$42,198,476	\$142,300,583
<b>CEICA PLAN 14</b>					
01	Lands and Damages	\$3,375,025	2%	\$75,700	\$3,450,725
02	Relocations - Utilities	\$3,600,000		\$0	\$3,600,000
06	Fish and Wildlife Facilities	\$42,007,060	54%	\$22,696,415	\$64,703,475
06	Fish and Wildlife Facilities - Monitoring and Adaptive Management	\$9,492,520	54%	\$5,128,809	\$14,621,329
09	Channels & Canals	\$23,417,643	54%	\$12,652,552	\$36,070,195
13	Pumping Plant	\$1,315,600	54%	\$710,819	\$2,026,419
30	Preconstruction Engineering and Design (PED) - 25%	\$16,685,076	15%	\$2,452,706	\$19,137,782
31	Construction Management (S&A) - 7%	\$4,671,821	31%	\$1,465,550	\$6,137,372
	<b>TOTAL PROJECT COST</b>	\$104,564,745		\$45,182,550	\$149,747,295
Notes					
O&M will be required for each alternative after construction is completed. Total duration of 45 years.					
Assumed construction duration of 5 years for each alternative					