Kennedy/Jenks Consultants

San Elijo Joint Powers Authority
Outfall Preliminary Design Report

June, 2015

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I. Background

The San Elijo Joint Power Authority (SEJPA) owns the San Elijo Water Reclamation Facility (SEWRF), which includes a water pollution control facility and water reclamation facility that utilizes an ocean outfall for effluent discharge. The SEWRF outfall system consists of approximately 3,000 linear feet of 30-inch class 100 asbestos cement pipe across the San Elijo Lagoon installed in 1964, and 4,192 linear feet of 30-inch RCP and 4,000 linear feet of 48-inch reinforced concrete pipe ocean outfall. The outfall portion on land crosses the San Elijo Lagoon, the existing railroad tracks, and Highway 101. Under the railroad tracks the pipe is encased for 90 feet in a 50-inch internal diameter steel pipe casing with 5/8 inch wall thickness, in which the void space is filled with sand. In April 2015, SEJPA completed a Facility Master Plan, which included a desktop condition assessment of the existing outfall system. This desktop assessment indicates the pipe is likely nearing the end of its useful life.

Several other projects are currently in planning and design that will affect the lagoon in the immediate vicinity of the outfall. San Diego Association of Governments (SANDAG) plans to expand the existing railroad tracks that cross the lagoon. This is referred to as the Double Track Project. The expansion of the railroad is of particular concern because there will be additional soil loads and live loads applied to the existing outfall pipe. The additional fill is anticipated to cause new settlement of the soil around the outfall pipe, which could result in damage to the outfall if not appropriately protected. The railroad work is being planned simultaneously with the North Coast Corridor expansion of the I-5 Freeway. In addition, the Lagoon Restoration project will be taking place. All of these projects have the potential to greatly impact the lagoon because they include construction of levees, grading and altering the water level within the lagoon. Since the SEJPA is interested in replacement or rehabilitation of the land portion of their outfall in the near future, it would be most advantageous to replace or rehabilitate this outfall prior to or concurrently with other proposed construction work in the vicinity. Per SEJPA's understanding, the construction timeframe of various other projects' activities that are of a particular interest to the SEJPA Outfall Project are outlined in Table 1.

Table 1. Related Project Schedule Milestones (Approximate)

Year	Quarter	Activities
2016	Q1	Begin lining of existing Escondido sewer in Manchester
2016	Q1	Construction of levee and water control at I-5 crossing lagoon and install water control levee at lagoon opening
2016	Q3	Establish laydown area on beach in area of outfall pipeline
		Install a sleeve casing under railroad for lagoon discharge piping
2016	Q4	Levee installed across lagoon with water control. Levee is upland side of outfall pipe
2017	Q1	Flooding of Lagoon south of levee across lagoon for 7 months duration
2017	Q2	Shore disposals in vicinity of our outfall tie-in
2017	Q3	Lagoon work around north rim of lagoon
2017	Q4	Most of Lagoon work is done

The intent of this report is to evaluate alternatives for replacing or rehabilitating the lagoon/land section of the outfall. The alternatives to be evaluated include the following and each will be discussed in further detail below:

- Open Cut Installation
- Trenchless Installation
  - Single HDD
  - HDD with Pipe Ramming
- Rehabilitation
  - Sliplining
  - Cast-in-place liner (CIPP)

II. Discussion of Installation Alternatives

A. Open Cut Installation

An open cut installation of the pipeline may be possible because a portion of the lagoon will be temporarily isolated with a levee and dewatered. The open cut could be installed on the "dry" side of the levee, or it could be installed in the levee itself. Installing the pipe in the levee would require crossing two channels, which are spanned by pedestrian bridges. Since open cut construction in the channel areas would likely be prohibited for environmental reasons, the only available option may be to attach the outfall to the pedestrian bridge, which is not likely to be feasible. The construction of this option would also need to be closely coordinated with the levee work, which may cause scheduling and coordination issues for multiple contractors working in the same area concurrently.

The dewatering operations of the Double Track and Lagoon Restoration Projects may also be insufficient for constructing a new outfall. The groundwater level for the above projects would have to be lowered by an additional 6 ½ feet in elevation to allow for the new outfall pipe trench excavation. The added depth of dewatering will increase the cost of this alternative.

An open trench installation would also require use of heavy equipment throughout the lagoon area. The soft soil typical in the lagoon is not only environmentally sensitive; the weak nature of this soil may make use of heavy equipment on the lagoon bottom impractical.

Finally, Kennedy/Jenks has been advised by the California Coastal Commission that an open trench outfall construction option would likely be denied because of the invasive nature of construction.

Although a new pipeline can be considered to have a useful life of 100 years, due to the significant cost, environmental and permitting issues discussed above, this option is considered infeasible and is therefore eliminated from further consideration as a viable option.

B. Trenchless Installation

Construction of a new outfall pipeline across the railroad tracks would mitigate risk of damaging the older existing asbestos cement outfall during construction of the Double Track Project. However, in order to do this, the schedule of the trenchless construction would have to take place prior to the Double Track construction. This would require an accelerated schedule for the design and construction of the new outfall.

Trenchless installation of the pipeline across the lagoon presents unique challenges and advantages. The environmental impacts of a trenchless installation are significantly reduced in comparison to open trench construction, making it easier to permit. Some encroachment in the lagoon may be necessary for construction of the launching and receiving areas, but large excavated pits are not required for surface launched Horizontal Directional Drilling (HDD). Two HDD approaches have been evaluated and are presented below.

1. A single Horizontal Directional Drilling (HDD) operation launched from the visitor center area can extend all the way to the beach. In doing so, HDD would cross both the RR tracks and Highway 101. See Figure 2.
2. HDD from the east side of the railroad tracks across the lagoon to the visitor center could also be considered. A pipe ramming installation with a casing could be used to cross the railroad tracks. A separate pipe ramming installation crossing Hwy 101, ending on the beach, would also be required. See Figure 3. Pipe ramming is most ideal for these shorter stretches because it limits the potential for settlement under the tracks and Hwy 101 and can be constructed in high groundwater areas, if the entrance shaft is dewatered.

Once the lagoon is crossed, a bend is required to cross the visitor center parking lot, since the turning radius limitations of an HDD will not accommodate a continuous alignment in the visitor center area. Both of these options would have an HDD staging area at the west end of the visitor center parking lot and extend easterly across the parking lot using open cut construction methods. The open trench section of pipe would be about 500 linear feet across the length of the parking lot and would connect to the junction structure near its entrance, then end at the PVC pipe north of Manchester in the SEJPA driveway.

Geotechnical Considerations - HDD Construction

Kennedy/Jenks has obtained and reviewed three recent geotechnical reports from nearby projects: the Double Track (Ninyo & Moore, 2012), the Visitor Center (Ninyo & Moore, 2007), and the Solana Beach Force Main installation (Allied Geotechnical Engineers, 2006). A map of the available soil borings is shown on Figure 1. The geotechnical exploration for the railroad Double Track Project encountered loose to medium dense sand with varying amounts of silt (estuary deposits) near the alignment of the proposed outfall pipeline. The siltstone and claystone of the Del Mar Formation was encountered approximately 95 feet below ground surface (bgs) in the boring closest to the proposed alignment, near the southern portion of the project area. However, the top of the Del Mar Formation was encountered much closer to the ground surface in borings north of the project area, as well as in the borings taken for the Visitor Center Improvements. At the location of the visitor's center, the top of the Del Mar formation may be as shallow as two feet below ground surface, while beneath the San Elijo Lagoon it is likely significantly deeper. Therefore, either trenchless option under consideration would likely involve drilling through both the sand and silt of the estuary deposits and the silt and claystone of the Del Mar Formation.

Both the estuary deposits and the Del Mar Formation would be feasible units for HDD construction, although the Del Mar Formation would be a slower drilling process. The ideal geotechnical conditions for HDD are clay-rich fine-grained soils, followed by cohesionless fine sands and silts that can be suspended in the drilling fluid for sufficient amounts of time, allowing for effective transportation of the soil cuttings. Soils should ideally be medium dense to dense to promote borehole stability and steering response. Both the denser portions of the estuary deposits and the sedimentary bedrock should result in a stable borehole with reduced risk of hydro fracture and settlement at the ground surface. Design features can be implemented to minimize geotechnical risks, including conductor casings near the surface, and proactive specification requirements such as annular space pressure monitoring.

1. Option 1: Single HDD

This HDD option would begin just south of the visitor center and end on the beach just west of Hwy 101 (Figure 2). In order to avoid impacts to both the lagoon channel and Hwy 101, the HDD entry and exit points would need to be set back from these features. The bore alignment will also be designed with sufficient depth below these features, with 40 feet or more below ground surface. The proposed alignment is limited by the minimum bend radius of the steel rods used to drill the borehole.

a) Pipe Insertion Options

It is preferable that the product pipe be completely assembled and pulled into the borehole in one continuous length in order to reduce the risk of borehole collapse mid-pull.

If the borehole is drilled from north to south, the pipe could be assembled off-site and then pulled into the borehole from the ocean using the assistance of tugboats or other marine support. This is not an uncommon practice for HDD outfall installations. Some projects where this method was utilized include the Hueneme Outfall Pipeline for the Calleguas Municipal Water District in Port Hueneme, CA. Pullback of 2,300 feet of 36-inch HDPE was performed in 2010. The pipe was assembled at the Navy Base at Point Mugu south of the drill. Another recent project was the Lake Oswego Tigard Joint Water Partnership (2014), where 4,000 feet of 36-inch steel pipe was assembled in North Portland and towed to Lake Oswego down the Willamette River in 300-foot sections. Once they reach the project area, the sections are welded together in the water using barges.

If the borehole is drilled from south to north, pipe could be assembled within the visitor center parking lot and along the shoulder of Manchester Avenue. This option would likely interrupt Visitor Center traffic for approximately 3 weeks. Some mitigating measures to the traffic impact may include temporary parking at SEJPA treatment plant across the street, or constructing a temporary pipe truss system over the driveway entrance to the visitor center allowing cars to drive underneath.

b) Pipe Material Considerations

Both high density polyethylene (HDPE) and fusible polyvinyl chloride (fPVC) are being considered for this installation. The primary advantage of fPVC over HDPE is a higher tensile strength with a reduced wall thickness, resulting in a larger flow rate for a given outer diameter. This can have an impact on the price and complexity of the HDD, as both cost and risk are correlated with external pipe diameter. However, fPVC has a larger minimum bend radius as compared to HDPE which will result additional easement from State Lands Commission.

It is important to note that this alignment assumes that crossing the railroad tracks is possible without the use of a casing pipe, which is the standard North County Transit District (NCTD) railroad permit requirement. A variance to this requirement is often granted to projects if they can be proven to have minimal impact to the rail. Potential railroad impacts will be minimal to non-existent, as the borehole will likely be more than 40 feet deep at the crossing location. Discussions with NCTD have yielded that they approve of this approach

and final approval of a permit would be contingent upon review of the project plans at each submittal phase.

2. Option 2: HDD with Pipe Ramming

Option 2 is similar to Option 1, but ends on the east side of the railroad tracks (Figure 3). Because it is likely not feasible to loft product pipe over the railroad tracks for pullback, product pipe laydown would need to be on the north side, using the visitor center parking lot and the shoulder of Manchester Avenue. As discussed above, this option would likely interrupt Visitor Center traffic for approximately 3 weeks. Some mitigating measures to the traffic impact may include temporary parking at SEJPA treatment plant across the street, or constructing a temporary pipe truss system over the driveway entrance to the visitor center allowing cars to drive underneath.

To reach the beach, the outfall pipeline would require two short trenchless crossings of Hwy 101 and the railroad tracks. Due to the length of the crossings, the size of the anticipated casing to be installed, and the presence of groundwater at or near the ground surface, it is likely that these crossings would be constructed using pipe ramming, which typically provides greater protection against settlement and other surface impacts than open-faced methods such as auger boring (jack and bore) below the water table. Dewatering of the inlet pit for pipe ramming will be required. As the distance is too far to do the entire crossing in one drive, two separate borings would be installed for the pipeline to cross the railroad tracks and Hwy 101.

Comparison of HDD Options 1 and 2

Both HDD options would have a pipe installed via open trench across the visitor center parking lot from the HDD staging area to the junction structure, across Manchester and tie into existing pipe in the SEWRF driveway. This disturbance to visitor center traffic can be minimized by providing temporary public parking at the SEWRF facility across the street. A crossing guard could be provided to facilitate safe public crossing.

Of the two options, Option 1 is both less expensive and will result in significantly reduced impacts to the lagoon area. In contrast, Option 2 will require a large amount of construction work within the lagoon, including a large work area for the HDD entry point just east of the railroad tracks, and construction of shafts on either side of both the railroad tracks and Hwy 101. Therefore, provided a casing is not required by the railroad, it is recommended to pursue Option 1.

One potential risk of trenchless construction is that the gradient of the pipeline may deviate from the design grades slightly. This may result in minimal loss of capacity, but compared to optimal hydraulics is not deemed significant enough to affect the outfall capacity. Other

inherent risks of trenchless installation include contact with unknown subsurface utilities/structures along the bore path. Due to these factors, trenchless installation is considered to have a construction risk, but considering the expected lagoon impact from other techniques, places it in a lower risk category by comparison and a much lower environmental risk profile. The useful life of a new HDPE or fPVC pipe installed using trenchless methods is expected to be ~100 years.

C. Rehabilitation of Existing Pipe

In 2014, SEJPA as part of the Master Plan performed a desktop condition assessment of the existing 30-inch pipeline. It was estimated that the cost of a physical inspection via acoustic pipe wall stiffness assessment would be approximately $77,000. A physical pipe inspection would not necessarily be an accurate representation of the entire pipeline or the remaining useful life of the pipe. Since there is currently no physical data to document the actual condition of the pipeline, it is unknown if the existing pipe has structural deficiencies or would be a suitable candidate for a liner. At a minimum, it is recommended that a video inspection of the pipe be performed prior to further consideration of a CIPP liner. The cost of a video inspection would be ~$25/ft, or $62,500, which does not include the cost of a bypass. One option is to cleanse the outfall to the extent possible with clear recycled water and conduct the video under submerged conditions. The other is to install a bypass to allow CCTV through the outfall in an empty state.

For the area where the existing pipe crosses the railroad tracks, SANDAG worked with HDR Consultants to prepare a 30-inch Sewer Outfall Protection Memorandum for the San Elijo Lagoon Double Track Project, dated February 5, 2015. The purpose of the memorandum was to evaluate protection of the existing 30-inch asbestos cement outfall during the construction of the railroad. "The proposed SELDT (San Elijo Lagoon Double Track) project second track will be about 3.5 feet higher and offset 15 feet east of the existing mainline. This will require additional fill and rail loading on a portion of the sewer which is not protected by steel casing. The additional fill is anticipated to cause new settlement of the soil around the outfall pipe, which could result in damage to the outfall if not appropriately protected. In order to accommodate the second track and embankment the sewer will require an additional 50 feet of linear protection." Various sewer protection alternatives were considered in the memo, and HDR recommends that if the outfall is to remain in place, constructing a protection slab on piles for approximately 50 feet along the outfall is the best method of protecting the existing pipe in place.

One major consideration with pipe lining techniques is that they have not been tested over a long time span. Insituform, a noted CIPP installer, has documented the installation of a CIPP liner over a 40-year span. They have performed core samples every ten years on test

sections of the liner. Based on the results of the core samples, Insituform states that the life expectancy of a new CIPP installation would be up to 100 years. However, for the purposes of this evaluation, we base the expected life of a CIPP liner on the documented installation and assume that the life of a rehabilitated pipeline will be 50 years.

The rehabilitation of existing pipe would require a full shut down of the existing pipe and the installation of a bypass system. Since the outfall is currently rated at 25.5 MGD, the bypass system should be capable of transferring this peak flow, with an appropriate factor of safety. The anticipated shut down time of the outfall would be approximately 2 weeks, which includes cleaning the pipe and installing a new CIPP liner. The bypass pipe would have to cross the railroad and the Hwy 101. Crossing the railroad may be possible by temporarily using a steel casing which will be installed as part of the Double Track work. This would require strategic scheduling with the double track contractor. Options to cross Hwy 101 are somewhat limited, and may require installation of a new pipe installed via pipe ramming. The bypass pipe could potentially follow the outlet from the lagoon and extend through the existing culvert under the railroad and Hwy 101.

To install CIPP for the entire 2,500 linear foot outfall, installation will need to be performed in two sections, approximately 1,250 linear feet each. This would require an access structure in the center of the lagoon. Building this structure is an additional cost and would likely need to be installed with a barge. There would need to be dewatering during the installation of the access structure. See Figure 4.

III. Permitting

The project is located within the jurisdiction of multiple local, state, and federal agencies that will require permits in order to successfully implement the project. The agencies having jurisdiction over the project include the United States Army Corps of Engineers (USACE), United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), Regional Water Quality Control Board (RWQCB), California Coastal Commission (CCC), City of Encinitas, North County Transit District (NCTD), and California State Lands Commission (CSLC). Initial contact was made with these agencies to acquire a preliminary idea of what permits each agency might require. An overview of the project and the different installation alternatives that are being considered to be utilized were discussed with the agencies. Through these discussions, the agencies provided their preliminary thoughts on what permits might be required for the project. The table below summarizes what permits might be required for the various agencies and the expected timeframe for the permitting process. More detailed summaries for the expected permitting process for each agency are provided below.

Table 2. Expected Permits and Timeframes

Agency	Expected Permits Required	Expected Permitting Timeframe (Approx.)
USACE	Nationwide Permit 12	45 days – 12 months
	Individual Permit	6 – 12 months
USFWS	No permit required but an informal or formal consultation might be	Informal: A couple days or months Formal: 3 months or more
CDFW	Lake and Streambed Alteration	30 – 90 days
RWQCB	401 Water Quality Certification	6 – 12 months
	Waste Discharge Requirements	6 – 12 months
CCC	Coastal Development Permit	3 – 6 months
City of Encinitas	Coastal Development Permit	3 – 6 months
	Major Use Permit	6 – 12 months
NCTD	Right of Entry Permit	1 – 2 months
CSLC	Easement in Lagoon	3 months

United States Army Corps of Engineers

The USACE indicated that one of two different permits would be required. The first permit that could be required is the Nationwide Permit 12 which is for utility line activities. The Nationwide Permit 12 could take 45 days to permit as a best case scenario, but a timeframe of about 6 months should be planned for. If open cut installation is selected this permit could take approximately 9-12 months to permit. The second permit that could be required is the Individual Permit, which is required if the project doesn't qualify for a Nationwide Permit 12. The individual permit requires more public involvement and is evaluated under a public interest review. The Individual Permit could take approximately 6-12 months to process. The USACE does not require final, stamped plans to apply for these permits, although it is recommended to be as far along as possible before applying to minimize changes and the potential for having to resubmit. The USACE recommended that a pre-project consultation meeting (hosted by CDFW and attended by USACE) be attended to discuss the project and permitting process in more detail. The USACE indicated that they would be willing to schedule an individual meeting also.

United States Fish and Wildlife Service

The USFWS indicated that no individual permit is required from them. The USFWS coordinates with the USACE and would get involved through them. If the USACE determines that listed species will

be impacted by the project the USFWS will get involved. If the USACE determines that listed species will not be impacted by the project then the USFWS will not get involved, unless they disagree with the USACE's determination in which case they can get involved. The work USFWS completes is in accordance with Section 7 of the Endangered Species Act and is required if the USACE requires an Individual Permit. The USFWS will conduct either a formal or informal consultation to void or minimize impacts of the project. An informal consultation is more like an agreement that says the project might have an effect and measures will be taken to minimize the effects to an insignificant level. An informal consultation can take from a couple of days up to over a year, but it is anticipated that it would be a shorter timeframe. A formal consultation is more detailed in what conservation measures are going to be used to void or minimize impacts. A formal consultation requires more coordination between the USFWS and representatives of the project on what conservation measures will occur, and as a result this process generally takes at least 3 months. The preferred installation method would be HDD as it would be the least invasive and might not require the USFWS to get involved. The USFWS recommended that a pre-project consultation meeting be attended to discuss the project and potential involvement of USFWS in more detail.

California Department of Fish and Wildlife

The CDFW indicated that regardless of what installation method is selected a Lake and Streambed Alteration (LSA) notification would be required. The LSA could take approximately 30-90 days to process, but the clock stops if CDFW is waiting any information or documents needed to process the LSA. Applying for the LSA can occur before final, stamped plans are developed, but the final, stamped plans will need to be submitted when they are ready. The CDFW would be willing to schedule a pre-project consultation meeting to discuss the project and permitting process in more detail. Pre-project consultation meetings are hosted by CDFW and held on the second Tuesday of every month, and the USFWS, USACE, and the RWQCB typically attend these meetings as well.

Regional Water Quality Control Board

The RWQCB indicated if the USACE requires a Section 404 Permit then they would require a 401 Water Quality Certification regardless of what installation method is selected. If a 401 Water Quality Certification is not required then a Waste Discharge Requirements would be required. The CEQA process would need to be finalized and submitted prior to applying for permits from the RWQCB. The permitting process for RWQCB could take approximately 6 months – 1 year. Depending on what installation method is selected additional permits such as dewatering permits, construction storm water permits, stockpiling permits, groundwater extraction permits, etc would be required. RWQCB recommended that construction storm water permits be applied for regardless of the installation method selected. Construction storm water permits require a SWPPP to be completed. Final, stamped plans are not required to begin the permitting process, but changes would have to be noted and approved once final plans are developed. RWQCB attends the

pre-project consultation meetings hosted by CDFW and recommended that it would be a good idea to attend one of these meetings to discuss the project and permitting in more detail.

California Coastal Commission

The CCC indicated that a Coastal Development Permit (CDP) would be required for the portion of the project within San Elijo Lagoon. This permit could take approximately 3-6 months to permit if an installation method with little to no impacts is selected, and more time to permit if a more invasive installation method is selected. The CCC advised that open cut installation would most likely not get permitted due to how invasive it would be. Applying for the CDP can occur before final, stamped plans are developed. The CCC indicated that they would like to be involved with the project as early as possible to minimize potential issues down the road during design, and that they would be willing to schedule a meeting to discuss the project and permitting process in more detail.

City of Encinitas

The City of Encinitas indicated that several permits would be required. In addition to a CDP being required by the CCC, a CDP would also be required by the City of Encinitas. Both agencies have the authority to issue CDPs, and the project falls within both of their jurisdictions. The CDP could take approximately 3-6 months to permit. The CDPs for both agencies might be able to be combined into one overall CDP. The project would also most likely trigger a Major Use Permit (MUP), which would take approximately 6-12 months to permit. The permitting process for the CDP and the MUP would run concurrently. The various departments within the City of Encinitas would also review the plans for the project and be signatory to the plans. Prior to construction activities, an encroachment permit would be required which would be filed for and obtained by the contractor. The City of Encinitas would be willing to schedule a Staff Advisory Committee meeting, which occur every Wednesday, to discuss the project and permitting process in more detail.

North County Transit District

The NCTD indicated that a Right of Entry Permit (REP) would be required regardless of the type of installation method selected. The REP permitting process could take approximately 1-2 months. NCTD's standard practice is to require a casing whenever a pipe crosses the NCTD easement. The possibility of obtaining a waiver for the requirement of a casing under the railroad tracks was a discussed with NCTD. There are several factors that go into determining if a casing is required such as depth of the pipe, material of the pipe, expected service life of the pipe, types of joints used, etc. NCTD wants to ensure that the possibility of leaks and floods are minimized as much as possible. A meeting was held with NCTD at San Elijo Water Reclamation Facility on June 5 to discuss the project specifics with NCTD. NCTD staff indicates that the HDD concept without a casing (Option 1) is accepted based on final approval of plans and specifications. Kennedy/Jenks will continue to coordinate with NCTD throughout the final design phase to promote NCTD acceptance.

California State Lands Commission

The CSLC is responsible for issuing the necessary easement to SEJPA for the path of the outfall. The outfall is currently located in an existing 30 foot wide easement that SEJPA has. A request has been made to the CSLC to extend this easement an additional 10 feet on each side of the pipe to make the total easement 50 feet wide. If a new pipe is installed, it is likely that additional easement within the lagoon would be required. When the final pipe alignment is determined, Kennedy/Jenks will prepare and submit a legal description along with the easement application.

IV. Cost Estimates

Preliminary Class 4 Cost Estimates have been prepared for Trenchless Option 1, Trenchless Option 2, and outfall rehabilitation with CIPP Lining. The estimate was prepared using civil construction cost estimating software and was drawn from information provided about the project available at the time. The source of the unit costs are recent cost data from similar projects size and type, unit cost information from contractors and suppliers, and trenchless cost information provided by Staheli Trenchless and trenchless construction contractors. The construction cost estimate was based on California prevailing wages to be paid by the contractor to its construction team members. A breakdown of these estimates is attached to the report.

Table 3. Cost Estimate Summary

Installation Alternative	Estimated Range of Probable Cost	
	Total Est.	+30%
Trenchless Option 1: Single HDD	$4,040,000	$5,252,000
Trenchless Option 2: HDD with Pipe Ramming	$4,830,000	$6,279,000
Rehabilitation CIPP Lining	$5,010,000	$6,513,000

V. Evaluation

A. Evaluation Criteria

SEJPA has identified Criteria to be used in evaluating each of the installation methods. Applying these criteria each installation method will receive a score of 1-10 based on how well the alternative fulfills the criteria, with 10 being the most positive score. The Criteria include:

- Ease of Permitting/ Minimizing Environmental Impact
- Constructability

- Cost
- Hydraulics
- Construction Risk
- Scheduling and Coordination with Other Projects/ Preference of other Entities
- Useful Life

Ease of Permitting

Extensive coordination will need to take place with several different agencies including the U.S. Army Corps of Engineers (USACOE), U.S. Fish and Wildlife (USFWS), California Dept. of Fish and Wildlife (CDFW), Regional Water Quality Control Board (RWQCB), and California Coastal Commission (CCC).

Constructability

Evaluation of constructability will consider the feasibility/suitability of the installation technology for the specific conditions provided by this project.

Cost

An Opinion of Probable Construction Cost (OPCC) estimate, Class 4, has been prepared for installation alternatives deemed to be feasible in other categories.

Hydraulics

Hydraulic influences of each option is discussed and evaluated. This includes impacts resulting from any changes in inside diameter, changes in material/lining, or changes in slope.

Construction Risk

Evaluation of construction risk entails consideration of the likelihood of a change in cost during construction, and anticipated safety risks.

Scheduling and Coordination with Other Projects

The construction of the outfall replacement/ refurbishment will need to be coordinated with the North Coast Corridor Project (NCCP), the SANDAG Double Track project, and the Lagoon Restoration Project. The ease with which the installation method can cooperate with these projects is a major determining factor. A San Elijo Lagoon Integration Core Team Charter has been formed to facilitate the communication and coordination of these projects in order to enhance environmental protection, safety, public perception and to minimize costs.

Useful Life

The existing asbestos cement outfall pipe is 50 years old and according to the SEJPA Facility Update Plan (April 2015 Final Report), is nearing the end of its useful life. Because of the environmentally sensitive habitat, the SEJPA values the ability to maximize the life of its infrastructure so that the potential for disturbing the habitat is minimized. Additionally, longer service life for infrastructure means lower capital costs over the life of an asset.

B. Hydraulics Comparisons

Although a full hydraulic analysis of the pipeline has not been performed within the scope of this report, a general cross-sectional hydraulic analysis has been prepared to compare various materials and commercially available sizes. As discussed previously in this report, HDPE and fPVC have been identified as favored materials for installation of a new pipe.

In the case of a new trenchless installation, a commercially available pipe size would be selected to have an inside diameter (I.D.) as close to 30-inches as possible to match the I.D. of the existing pipe, while keeping in mind that increases in outside diameter drives up the cost and risk of the project. Therefore, pipe I.D. sizes of 29.91 and 28.73 inches for fPVC and HDPE, respectively, were selected.

A sliplining application would require a new pipe with an outside diameter (O.D.) small enough to fit inside the existing 30-inch pipe. The commercially available size of fPVC that would fit in the existing AC pipe has an O.D. of 25.80 inches, and an I.D. of 24 inches. A 24 inch pipe is considered to restrict the flow too much compared to the existing 30 inch and would therefore not be a suitable material for sliplining.

Table 4. Existing Pipe Hydraulic Conditions

Pipe Type	Pipe Flow		Pipe O.D.	Pipe I.D.	Pipe Area	Velocity	C factor	H_L/100 ft
	mgd	gpm	in	in	sqft	fps		ft
AC	25.5	17,708	--	30	4.91	8.04	140	0.53

Table 5. Proposed Pipe Hydraulic Conditions (based on existing flow)

Pipe Type	Pipe O.D.	Pipe I.D.	Pipe Area	Pipe Flow		Velocity	C factor	H_L /100 ft
	in	in	sqft	mgd	gpm	fps		ft
Replace with new HDPE pipe								
HDPE (IPS)	32	28.73	4.50	25.5	17,708	8.76	150	0.58
Replace with new Fusible PVC								
Fusible C-905	32	29.91	4.88	25.5	17,708	8.09	150	0.47
Slipline with new HDPE pipe								
HDPE (IPS)	28	25.17	3.46	25.5	17,708	11.42	150	1.10

The existing outfall pipeline has been rated for 25.5 MGD. Assuming the flow is maintained, each of the materials and pipe sizes have been checked for what resulting velocity could be anticipated. A high velocity number would indicate that hydraulic pressures would be increased in the pipeline, resulting in greater hydraulic losses and potential decreased capacity of the system. Based on this analysis, installing a new fPVC pipe via trenchless methods or a CIPP liner would provide optimal system hydraulics compared to the other options.

C. Decision Matrix

As discussed in the body of this report, there are very different considerations of each alternative if the project is rolled in with the construction and permitting of the larger Double Track/Lagoon Restoration projects, or if the project is built and permitted independently of the other work. For this reason, two separate decision matrixes have been prepared.

Table 6. Decision Matrix

	Ease of Permitting	Constructability	Cost	Hydraulics	Construction Risk	Interfacing with other Projects	Useful life	Total (Max 70)	Score
Open Trench	1	2	8	9	4	5	10	39	**56%**
Trenchless Option 1: Single HDD	9	8	8	8	6	9	10	58	**83%**
Trenchless Option 2: HDD with Pipe Ramming	8	8	7	8	6	7	10	54	**77%**
Rehabilitation Sliplining	6	8	6	4	8	8	8	48	**69%**
Rehabilitation CIPP Lining	6	6	6	8	7	8	6	47	**67%**

VI. Recommendations

Based on the evaluation criteria stated above, a pipe installation via HDD Option 1 is recommended for the following reasons:

- This option has the least environmental impact of all the options as it avoids disturbance within the lagoon limits.
- Of the feasible installation options, HDD option 1 is the least expensive.
- No major obstacles are anticipated during the permitting process. Based on our conversations with NCTD, they approve of the approach and will be willing to work with SEJPA during the design to facilitate a waiver of the casing requirements.
- If the outfall is replaced prior to the double track work, the risk of damaging the existing pipe will be mitigated. Additional protection measures for the existing pipe

would not need to be installed by NCTD, which not only saves in project costs but also reduces associated risks of damaging the existing pipeline.

- This option provides the greatest independence from the NTCD and Lagoon Restoration Projects. The project can be installed virtually independent from the other projects, minimizing coordination efforts, and maximizing schedule flexibility.
- Option 1 provides the greatest expected service life (100 years).

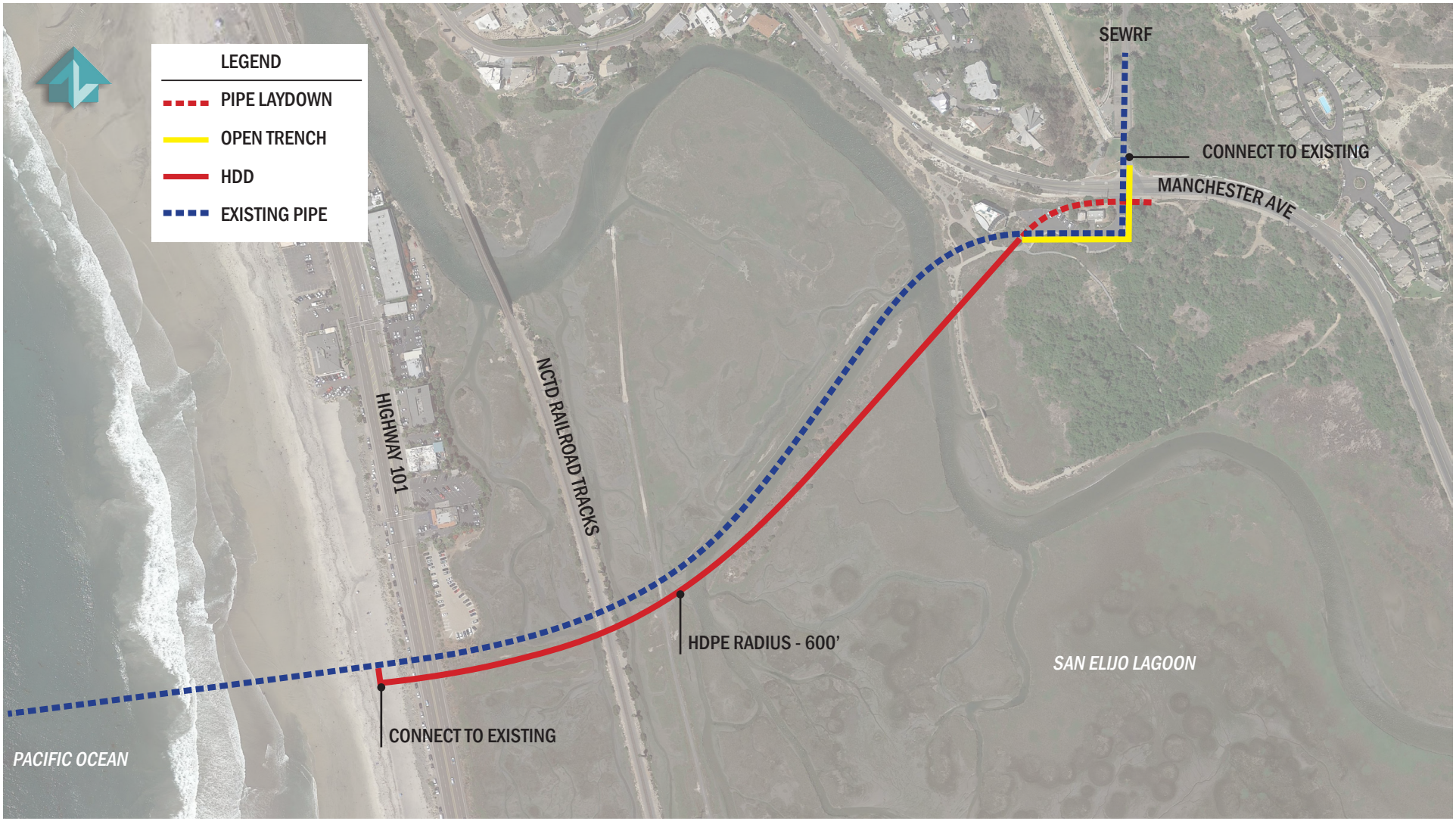
Kennedy/Jenks Consultants

SAN ELIJO JOINT POWERS AUTHORITY
FINAL REPORT

SOIL BORINGS PERFORMED FOR PREVIOUS PROJECTS

JUNE 2015

FIGURE 1



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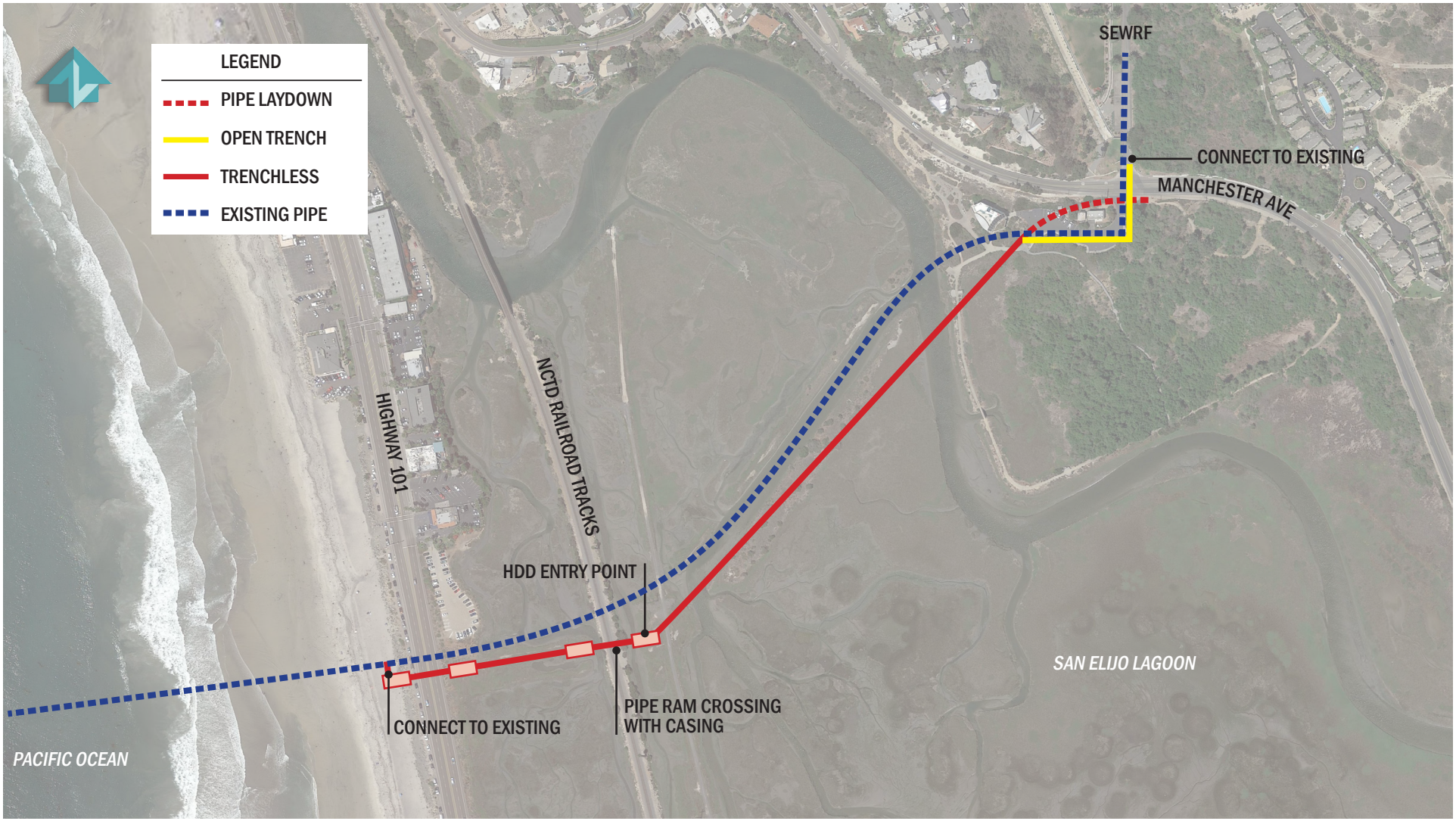
SAN ELIJO JOINT POWERS AUTHORITY
FINAL REPORT

TRENCHLESS OPTION 1 HDD ALIGNMENT

JUNE 2015

FIGURE 2



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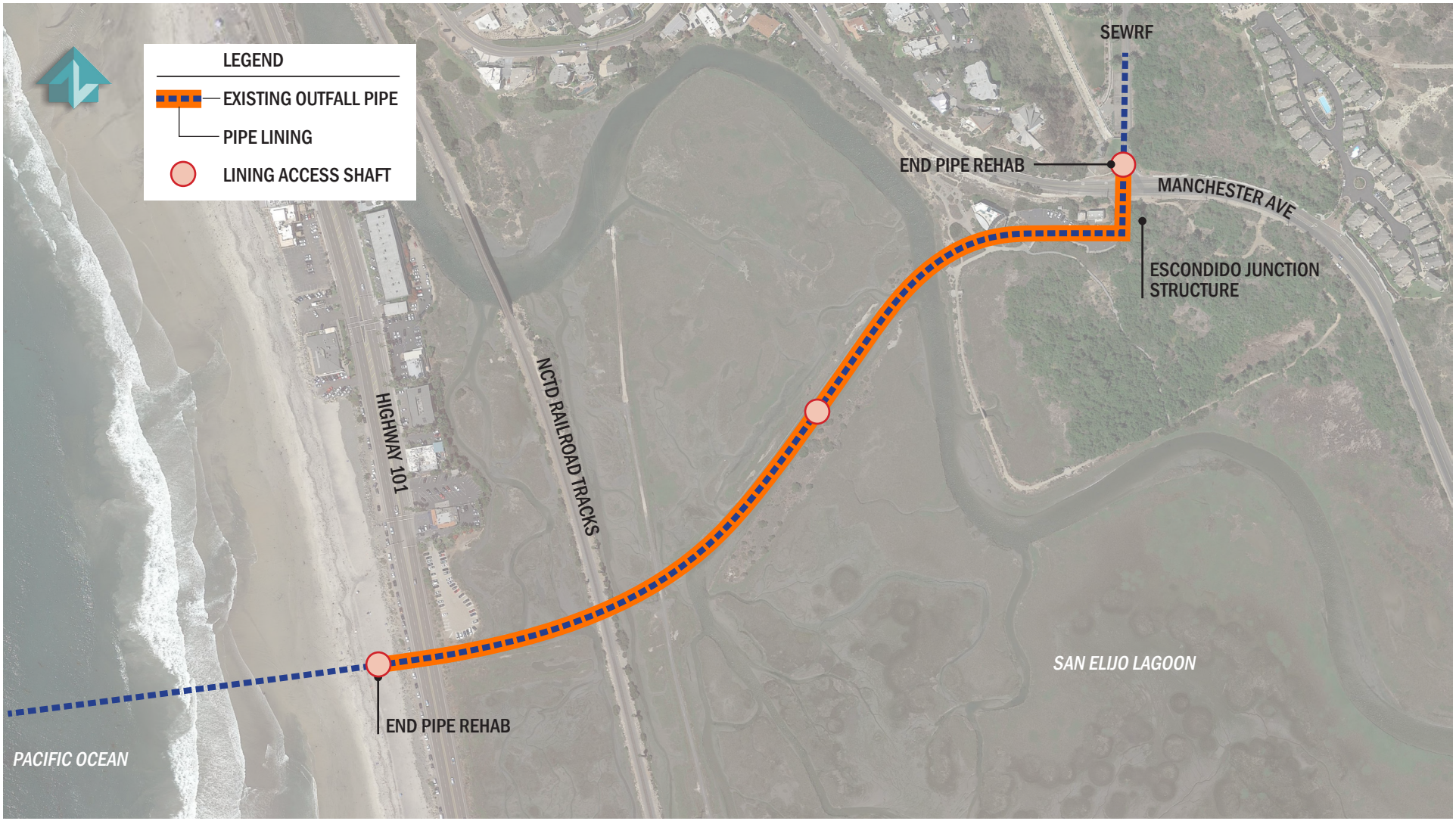
FINAL REPORT

TRENCHLESS OPTION 2 HDD/PIPE RAM ALIGNMENT

JUNE 2015

FIGURE 3



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SAN ELIJO JOINT POWERS AUTHORITY
FINAL REPORT

PIPE REHABILITATION

JUNE 2015

FIGURE 4

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: San Elijo Joint Powers Authority Outfall

Prepared By: JLH/SBW
Date Prepared: 27-Jun-15

Building, Area: **Option 1 - HDD Alignment**

K/J Proj. No. 1544100*00

Current at ENR 10,981
Escalated to ENR
Months to Midpoint of Construct 6

Estimate Type:
- ☐ **Conceptual**
- ☒ **Preliminary (w/o plans)**
- ☐ **Design Development @** **% Complete**
- ☐ **Construction**
- ☐ **Change Order**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
Site Prep											
		Surveying	1	LS			5,000.00	5,000			5,000
		Erosion Sediment Controls (Silt Fences, Straw Wattles, Catch Basin protection & Maint)	1	LS			10,000.00	10,000			10,000
		Temporary Fencing	1	LS			5,000.00	5,000			5,000
HDD Pipeline (2100 LF)											
		Mobilize HDD	1	LS					50,000	50,000	50,000
		HDD Pipeline 30"	2,100	LF	185.00	388,500			536	1,125,000	1,513,500
		Hydrostatic Testing	2,100	LF			4.00	8,400			8,400
		Traffic Controls (for HDD laydown)	1	MO			10,000.00	10,000			10,000
		Landscape Restoration/ Repairs (From HDD)	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
Open Cut Pipeline - Visitors Center & across Manchester (500 LF)											
		Sawcutting Paving	1,000	LF					2	2,000	2,000
		Remove & Dispose Paving (8' wide)	444	SY					15	6,667	6,667
		HDPE Pipe 30"	500	LF	185.00	92,500	41.00	20,500			113,000
		HDPE Pipe Fittings	3	EA	1,800.00	5,400	1,000.00	3,000			8,400
		Trenching 6' wide x 8' deep (Excavation & Backfill, Trenchbox)	500	LF			35.00	17,500			17,500
		Pipe Bedding	500	LF	18.00	9,000	10.00	5,000			14,000
		Dewatering Trench	500	LF			20.00	10,000			10,000
		Repaving over Trench 8' wide	444	SY					45	20,000	20,000
		Hydrostatic Testing	500	LF			4.00	2,000			2,000
		Traffic Controls (in parking lot/ Manchester)	1	LS	1,000.00	1,000	5,000.00	5,000			6,000
		Utility Tie Ins/ Repairs	1	LS			5,000.00	5,000			5,000
		Landscape Restoration/ Repairs (From open Cut)	1	LS	3,000.00	3,000	7,000.00	7,000			10,000
Connection At Junction Structure											
		Additional Excavation at Junction Structure	1	LS			3,000.00	3,000			3,000
		Additional Dewatering	1	LS			5,000.00	5,000			5,000
		Coordinate Shutdown/ Tie In	1	LS			2,500.00	2,500			2,500
		Piping Connection	1	LS	5,000.00	5,000	5,000.00	5,000			10,000
		Grout & Plug Existing Pipeline	1	LS	1,000.00	1,000	4,000.00	4,000			5,000
Connection to Existing At Beach											
		Excavation (Beach)	167	CY			20.00	3,333			3,333
		Shoring	1,050	SF	15.00	15,750	15.00	15,750			31,500
		Dewatering Pit (Beach)	1	LS					50,000	50,000	50,000
		Dewatering Water Treatment	1	LS	5,000.00	5,000	5,000.00	5,000			10,000
		Backfill & Compaction	167	CY			20.00	3,333			3,333
		Coordinate Shutdown/ Tie In	1	LS			2,500.00	2,500			2,500
		Piping Connection	1	LS	5,000.00	5,000	5,000.00	5,000			10,000
		Grout & Plug Existing Pipeline	1	LS	1,000.00	1,000	4,000.00	4,000			5,000
		Subtotals				537,150		191,817		1,253,667	1,982,633
		Division 1 Costs	@	8%		42,972		15,345		100,293	158,611
		Subtotals				580,122		207,162		1,353,960	2,141,244
		Taxes - Materials Costs	@	8.00%		46,410					46,410
		Subtotals				626,532		207,162		1,353,960	2,187,654
		Contractor OH&P	@	15%							328,148.06
		Subtotals									2,515,802
		Contractor Bonds & Insurance	@	2%							50,316
		Subtotals									2,566,118
		Estimate Contingency	@	25%							641,529
		Subtotals									3,207,647
		Escalate to Midpoint of Construct	@	3%							48,115
		Estimated Construction Cost									**3,256,000**
		Design Engineering	@	10%							325,600
		Permitting									200,000
		Construction Management	@	8%							260,480
		Total Estimated Project Cost									**4,040,000**

Estimate Accuracy	
+30%	15%

Estimated Range of Probable Cost		
+30%	Total Est.	15%
$5,252,000	**$4,040,000**	**$4,646,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: San Elijo Joint Powers Authority Outfall

Prepared By: JLH/SBW
Date Prepared: 27-Jun-15

Building, Area: **Option 2 - HDD/ Pipe Ramming Alignment**

K/J Proj. No. 1544100*00

Current at ENR 10,981
Escalated to ENR
Months to Midpoint of Construct 6

Estimate Type:
- ☐ **Conceptual**
- ☒ **Preliminary (w/o plans)**
- ☐ **Design Development @**
- ☐ **Construction**
- ☐ **Change Order**
- **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
Site Prep											
		Surveying	1	LS			5,000.00	5,000			5,000
		Erosion Sediment Controls (Silt Fences, Straw Wat	1	LS			10,000.00	10,000			10,000
		Temporary Fencing	1	LS			5,000.00	5,000			5,000
HDD Pipeline (1300 LF)											
		Excavation Receiving Area (Visitor Center)	167	CY			15.00	2,500			2,500
		Backfill & Compaction Receiving Area	167	CY			15.00	2,500			2,500
		Mobilize HDD	1	LS					50,000	50,000	50,000
		HDD Pipeline 30"	1,300	LF	185.00	240,500			596	775,000	1,015,500
		Hydrostatic Testing	1,300	LF			4.00	5,200			5,200
		Traffic Controls (for HDD laydown)	1	MO			10,000.00	10,000			10,000
		Landscape Restoration/ Repairs (From HDD)	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
Pipe Ramming (300 LF)											
		Prepare Launch Shaft									
		Excavation Launching Pits (2)	583	CY			15.00	8,750			8,750
		Shoring Launch Pit	3,000	SF	15.00	45,000	15.00	45,000			90,000
		Dewatering Launch Pit	2	WKS					20,000	40,000	40,000
		Dewatering Water Treatment	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
		Backfill & Compaction Launch Pit	583	CY			15.00	8,750			8,750
		Base course Launch Pit	39	CY	25.00	972	10.00	389			1,361
		Excavation Receiving Pits (2)	250	CY			15.00	3,750			3,750
		Shoring Receiving Pit (2)	1,800	SF	15.00	27,000	15.00	27,000			54,000
		Dewatering Receiving Pit (2)	2	WKS					20,000	40,000	40,000
		Dewatering Water Treatment (2)	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
		Backfill & Compaction Receiving Pit (2)	250	CY			15.00	3,750			3,750
		Mobilize Pipe Ramming	1	LS					40,000	40,000	40,000
		42" Rammed Steel Casing (2 drives)	300	LF					1,025	307,500	307,500
		30" HDPE Carrier Pipe DR 17	300	LF	125.00	37,500					37,500
		Hydrostatic Testing	2,100	LF			4.00	8,400			8,400
		Traffic Controls (for HDD laydown)	1	MO			10,000.00	10,000			10,000
		Landscape Restoration/ Repairs (From Pipe Rammi	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
Open Cut Pipeline - Between Shafts (500 LF)											
		HDPE Pipe 30" DR 11	500	LF	185.00	92,500	41.00	20,500			113,000
		HDPE Pipe Fittings		EA	1,800.00		1,000.00				
		Trenching 6' wide x 8' deep (Excavation & Backfill, Trenchbox)	500	LF			35.00	17,500			17,500
		Pipe Bedding	500	LF	18.00	9,000	10.00	5,000			14,000
		Dewatering Trench	500	LF			20.00	10,000			10,000
		Hydrostatic Testing	500	LF			4.00	2,000			2,000
		Landscape Restoration/ Repairs (From open Cut) Between Shafts	1	LS	5,000.00	5,000	10,000.00	10,000			15,000
Open Cut Pipeline - Visitors Center & across Manchester (500 LF)											
		Sawcutting Paving	1,000	LF					2	2,000	2,000
		Remove & Dispose Paving (8' wide)	444	SY					15	6,667	6,667
		HDPE Pipe 30"	500	LF	185.00	92,500	41.00	20,500			113,000
		HDPE Pipe Fittings	3	EA	1,800.00	5,400	1,000.00	3,000			8,400
		Trenching 6' wide x 8' deep (Excavation & Backfill, Trenchbox)	500	LF			35.00	17,500			17,500
		Pipe Bedding	500	LF	18.00	9,000	10.00	5,000			14,000
		Dewatering Trench	500	LF			20.00	10,000			10,000
		Repaving over Trench 8' wide	444	SY					45	20,000	20,000
		Hydrostatic Testing	500	LF			4.00	2,000			2,000
		Traffic Controls (in parking lot/ Manchester)	1	LS	1,000.00	1,000	5,000.00	5,000			6,000
		Utility Tie Ins/ Repairs	1	LS			5,000.00	5,000			5,000
		Landscape Restoration/ Repairs (From open Cut)	1	LS	3,000.00	3,000	7,000.00	7,000			10,000
Connection At Junction Structure											
		Additional Excavation at Junction Structure	1	LS			3,000.00	3,000			3,000
		Additional Dewatering	1	LS			5,000.00	5,000			5,000
		Coordinate Shutdown/ Tie In	1	LS			2,500.00	2,500			2,500
		Piping Connection	1	LS	5,000.00	5,000	5,000.00	5,000			10,000
		Grout & Plug Existing Pipeline	1	LS	1,000.00	1,000	4,000.00	4,000			5,000
Connection to Existing At Beach											
		Additional Excavation (Beach)	167	CY			20.00	3,333			3,333
		Shoring	1,050	SF	15.00	15,750	15.00	15,750			31,500
		Additional Dewatering (Beach)	1	LS					30,000	30,000	30,000
		Additional Dewatering Water Treatment	1	LS			5,000.00	5,000			5,000
		Backfill & Compaction	167	CY			15.00	2,500			2,500
		Coordinate Shutdown/ Tie In	1	LS			5,000.00	5,000			5,000
		Piping Connection	1	LS	5,000.00	5,000	5,000.00	5,000			10,000
		Grout & Plug Existing Pipeline	1	LS	1,000.00	1,000	4,000.00	4,000			5,000
		Subtotals				616,122		436,072		1,311,167	2,363,361
		Division 1 Costs	@	8%		49,290		34,886		104,893	189,069
		Subtotals				665,412		470,958		1,416,060	2,552,430
		Taxes - Materials Costs	@	8.00%		53,233					53,233
		Subtotals				718,645		470,958		1,416,060	2,605,663
		Contractor OH&P	@	15%							390,849.44
		Subtotals									2,996,512
		Contractor Bonds & Insurance	@	2%							59,930
		Subtotals									3,056,443
		Estimate Contingency	@	25%							764,111
		Subtotals									3,820,553
		Escalate to Midpoint of Construct	@	3%							57,308
		Estimated Construction Cost									**3,878,000**
		Design Engineering	@	10%							387,800
		Permitting									250,000
		Construction Management	@	8%							310,240
		Total Estimated Project Cost									**4,830,000**

Estimate Accuracy	
+30%	15%

Estimated Range of Probable Cost		
+30%	Total Est.	15%
$6,279,000	**$4,830,000**	**$5,554,500**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS

Project: San Elijo Joint Powers Authority Outfall

Prepared By: JLH/SBW
Date Prepared: 27-Jun-15

Building, Area: **Option 3 - Rehabilitation of Existing Pipe**

K/J Proj. No. 1544100*00

Current at ENR 10,981
Escalated to ENR
Months to Midpoint of Construct 6

Estimate Type:
- [ ] **Conceptual**
- [x] **Preliminary (w/o plans)**
- [ ] **Design Development @**
- [ ] **Construction**
- [ ] **Change Order**
- **% Complete**

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
Prep Work											
		Video Inspection of Existing Pipe	2,500	LF			25.00	62,500			62,500
		Pipe Inspection - Accoustic Wall Stiffness	2,500	LF			31.00	77,500			77,500
		Surveying	1	LS			5,000.00	5,000			5,000
		Erosion Sediment Controls (Silt Fences, Straw Wat	1	LS			10,000.00	10,000			10,000
		Temporary Fencing	1	LS			3,000.00	3,000			3,000
CIPP Lining Existing Pipe											
	Midway Point Access port for CIPP:										
		Temporary Roadway to Access Port Manhole Work A	1	EA					100,000		
		Temporary Bridge for Construction Equipment to Cro	1	LS					150,000		
		Excavation for Access Manhole(Lagoon)	167	CY			50.00	8,333			8,333
		Shoring	900	SF	20.00	18,000	35.00	31,500			49,500
		Install Manhole for Lining Access (Lagoon)	1	EA	15,000.00	15,000	35,000.00	35,000			50,000
		Dewatering Excavation (Lagoon)	1	LS					40,000	40,000	40,000
		Dewatering Water Treatment	1	LS	5,000.00	5,000	25,000.00	25,000			30,000
		Install Manhole in Lagoon for Lining Access (Lagoon	1	EA	10,000.00	10,000	15,000.00	15,000			25,000
		Landscape Restoration/ Repairs (Lagoon)	1	LS	25,000.00	25,000	100,000.00	100,000			125,000
		Mobilize CIPP Liner	1	LS					25,000	25,000	25,000
		Clean Existing Pipe	2,500	LF					23	56,250	56,250
		CIPP Liner	2,500	LF					225	562,500	562,500
		Hydrostatic Testing	2,500	LF			4.00	10,000			10,000
		Traffic Controls (at Junction Structure)	1	LS			2,500.00	2,500			2,500
Connection to Existing At Beach											
		Excavation (Beach)	125	CY			20.00	2,500			2,500
		Shoring	1,050	SF	15.00	15,750	15.00	15,750			31,500
		Install Manhole for Lining Access (Beach)	1	EA	15,000.00	15,000	15,000.00	15,000			30,000
		Dewatering Excavation (Beach)	1	LS					50,000	50,000	50,000
		Dewatering Water Treatment	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
		Backfill & Compaction	125	CY			15.00	1,875			1,875
		Coordinate Shutdown/ Tie In	1	LS			5,000.00	5,000			5,000
Bypass Piping											
		30" Bypass Pipe	2,500	LF	30.00	75,000	50.00	125,000			200,000
		Bypass Pipe Supports/ Anchors	2,500	LF	10.00	25,000	10.00	25,000			50,000
		Pumps	3	WKS			20,000.00	60,000			60,000
		Full Time Monitoring	3	WKS			25,200.00	75,600			75,600
		Landscape Restoration/ Repairs (From Bypass Pipin	2,500	LF			15.00	37,500			37,500
	Pipe Ramming (300 LF) to place bypass under 101 and RR										
		Prepare Launch Shaft									
		Excavation Launching Pits (2)	583	CY			15.00	8,750			8,750
		Shoring Launch Pit	3,000	SF	15.00	45,000	15.00	45,000			90,000
		Dewatering Launch Pit	2	WKS					20,000	40,000	40,000
		Dewatering Water Treatment	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
		Backfill & Compaction Launch Pit	583	CY			15.00	8,750			8,750
		Base course Launch Pit	39	CY	25.00	972	10.00	389			1,361
		Excavation Receiving Pits (2)	250	CY			15.00	3,750			3,750
		Shoring Receiving Pit (2)	1,800	SF	15.00	27,000	15.00	27,000			54,000
		Dewatering Receiving Pit (2)	2	WKS					20,000	40,000	40,000
		Dewatering Water Treatment (2)	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
		Backfill & Compaction Receiving Pit (2)	250	CY			15.00	3,750			3,750
		Mobilize Pipe Ramming	1	LS					40,000	40,000	40,000
		42" Rammed Steel Casing (300 LF, 2 drives)	300	LF					1,025	307,500	307,500
		Landscape Restoration/ Repairs (From Pipe Rammir	2	LS	5,000.00	10,000	10,000.00	20,000			30,000
		Subtotals				301,722		925,947		1,161,250	2,388,919
		Division 1 Costs	@	8%		24,138		74,076		92,900	191,114
		Subtotals				325,860		1,000,023		1,254,150	2,580,033
		Taxes - Materials Costs	@	8.00%		26,069					26,069
		Subtotals				351,929		1,000,023		1,254,150	2,606,102
		Contractor OH&P	@	15%							390,915
		Subtotals									2,997,017
		Contractor Bonds & Insurance	@	2%							59,940
		Subtotals									3,056,957
		Estimate Contingency	@	30%							917,087
		Subtotals									3,974,045
		Escalate to Midpoint of Construct	@	3%							59,611
		Estimated Construction Cost									**4,034,000**
		Design Engineering	@	10%							403,400
		Permitting									250,000
		Construction Management	@	8%							322,720
		Total Estimated Project Cost									**5,010,000**

Estimate Accuracy	
+30%	15%

Estimated Range of Probable Cost		
+30%	Total Est.	15%
$6,513,000	**$5,010,000**	**$5,761,500**