Peer Review of Conceptual Design Report

Avila Beach First Street Drainage

County of San Luis Obispo

November 10, 2023

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1. Introduction

1.1 Background

Avila Beach is a coastal community located on the north side of San Luis Obispo Bay in San Luis Obispo County. It is bordered along the south by the Pacific Ocean and along the west and north sides by San Luis Obispo Creek. The public parking lot located on 1st Street and area near the intersection of 1st Street and San Francisco Street is an area of low-lying topography (approximately 4-6 feet above mean sea level) and is prone to flooding during significant storm events. Businesses and residences in the area are affected by the flooding, which occurs fairly frequently.

This area is drained by a system of storm drain inlets, pipes, and open channels that collect and convey runoff to a 36-inch-diameter pipe that discharges to San Luis Obispo Creek. The storm drain outfall at the creek has a Tideflex duckbill check valve to prevent backflow of water from the creek into the storm drain system and connected low-lying area. The flooding at 1st Street and San Francisco Street occurs when the water surface elevation in the creek is high enough to prevent or limit the discharge from the storm drain system that drains the area.

In 2015, Cannon prepared the Avila Beach First Street Drainage Conceptual Design Report (Conceptual Design Report) (Cannon, 2015) for the County of San Luis Obispo (County). The purpose of the report was to document a study to develop, analyze, and recommend improvements to reduce flooding at the public parking lot and intersection of 1st Street and San Francisco Street. The report presents the following four alternatives for improvements to reduce flooding in the area:

1. **Alternative #1 – Gravity System into Sewer System**

   This alternative would connect the existing storm drain system to the existing sanitary sewer system in 1st Street. The connection would be controlled by a manually operated valve that would be opened when the parking lot is inundated to drain accumulated stormwater to the sanitary sewer system.

2. **Alternative #2 – Pumping Options**

   This alternative included three options for pumping accumulated stormwater from the flooded area. Ultimately, one option was carried forward that would install a pump at the parking lot that would discharge to a new outfall in San Luis Obispo Creek near the existing storm drain outfall.

3. **Alternative #3 – Standpipe**

   This alternative would install a standpipe above the mean higher-high water (MHHW) tidal elevation on the exiting outfall pipe to allow water to outfall when the duckbill check valve on the outfall is closed.

4. **Alternative #4 – Parking Lot Reconstruction**

   This alternative would regrade the parking lot and 1st Street to reduce flooding and improve drainage. Ultimately, this alternative was determined to be unfeasible due to effects on adjacent private properties and utilities in the area.

The recommendation in the Conceptual Design Report was that Alternative #2, installing a pump in the parking lot with a new outfall in San Luis Obispo Creek, was the preferred alternative for reducing flooding in the area.

The County retained GHD to provide a peer review of the Conceptual Design Report and to provide a recommendation for a project to move forward with to reduce flooding in the area.

1.2 Purpose of this Report

The purpose of this report is to summarize the findings of our review of the Conceptual Design Report and to document our recommendation for a project to move forward to reduce flooding at the public parking lot and the

intersection of 1st Street and San Francisco Street. In addition, this report identifies information gaps and additional consideration regarding permitting, engineering, and neighborhood coordination that will likely be needed to advance the project.

1.3 Scope and Limitations

GHD's scope for this project included the following:

- Conduct a review of the Conceptual Design Report prepared by Cannon in 2015 to evaluate the design criteria and methodology, technical analyses included in the report, alternatives presented, and the recommendation for the preferred alternative.
- Develop a recommendation for a project to move forward to reduce flooding in the public parking lot and in the area of 1st Street and San Francisco Street that would help advance the goals that the County has identified for the project.
- Prepare a report to summarize the findings of our review of the Conceptual Design Report and to document our recommendations for project continuation. The report should also identify information gaps and additional consideration regarding permitting, engineering, and neighborhood coordination that will likely be needed to advance the project.

This report has been prepared by GHD for County of San Luis Obispo and may only be used and relied on by County of San Luis Obispo for the purpose agreed between GHD and County of San Luis Obispo as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than County of San Luis Obispo arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions, and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.4 Assumptions

The findings and recommendations included in this report are based on the following assumptions:

1. The topographic survey provided by the County for this study is accurate and represents the existing conditions at the site, including topographic conditions, surface features, property lines, easements, and underground utilities.

2. Review of Conceptual Design Report

2.1 Approach to Review

The review of the Conceptual Design Report was focused on four main aspects, including design criteria, technical analyses, identified alternatives, and the selected preferred alternative. Each of these aspects is discussed below. For the review of the design criteria and technical analyses, the project was divided into two components: (1) interior drainage, which relates to the design of stormwater management facilities in the area of 1st Street and San Francisco Steet, including the parking lot, and (2) San Luis Obispo Creek, which relates to the condition of the creek at the storm drain system outfall. These two components combined affect the overall flood risk potential for the area.

2.2 Design Criteria

2.2.1 Interior Drainage

Design Storm

The storm event used for the design is a critical design criterion as it relates to the frequency at which flooding will occur in the area of 1st Street and San Francisco Steet, including the parking lot, and affects the design stormwater collection and conveyance facilities, such as inlets, pipes, and pumps. The larger the storm event used for the design of the flood control facilities, the less frequently flooding should be expected to occur.

Section 3.2 of the Conceptual Design Report refers to the Amendment to the Drainage Study for The Colony at Avila Beach (Cannon Associates, 2006) for the hydrologic methodology used for the analysis but does not state the hydrologic design criteria used. However, Appendix A of the report includes calculations based on “small storms” with 24-hour rainfall depths ranging from 0.1 inches to 1.0 inches. In addition, Figure 2 of the report shows approximate limits of inundation for the 24-hour storm events with rainfall depths of 0.4 inches and 0.8 inches and Section 7.0 of the report discusses a pump flow rate for Alternative 2 based on a 24-hour storm with a rainfall depth of 0.8 inches.

Based on this, it appears that the hydrologic design criteria used in the Conceptual Design Report is a 24-hour storm with a rainfall depth of 0.8 inches, although this is not explicitly stated in the report. It should also be noted that Section 3.6 and Appendix A of the Conceptual Design Report include calculations and output based on 24-hours storms with recurrence intervals of 5, 10, 25, and 100 years, but it is not clear how, or if, this information was used in the study.

According to the NOAA Atlas 14 data included in Appendix B of the Conceptual Design Report, a 24-hour storm with a recurrence interval of one year has a rainfall depth of 1.85 inches, so the storm used for the analysis with a rainfall depth of 0.8 inches is substantially smaller than that and would have a recurrence interval of less than one year. Based on the isohyetal map for Avila Beach in the County of San Luis Obispo Post Construction Requirements Handbook (County of San Luis Obispo, 2017), the 85th percentile 24-hour rainfall for the project area is approximately 1.1 inches, meaning that 15% of the storms in this area have a rainfall depth greater than 1.1 inches in 24 hours. The percentage of events having a rainfall depth of greater than 0.8 inches in 24 hours would be higher.

Using such a small rainfall event for the design of infrastructure intended to reduce flooding is not standard practice as it would result in the design of undersized infrastructure which would provide a minimal reduction in flood risk. GHD recommends the County clarify what design storm would be appropriate for this project.

Flood Inundation Elevation and Duration

The Conceptual Design Report does not discuss criteria for flood inundation elevation and duration, but we consider this to be critical design criteria for the project that should be defined. The flood inundation elevation is important because higher flood levels increase the risk to adjacent properties and infrastructure. Depending on the flood level, the impact could range from nuisance ponding in the parking lot to flooding buildings and other infrastructure, such as

the sanitary sewer lift station in the vicinity. The flood inundation duration is also important as the County may have a preference for how long the parking lot or roadway could remain closed during flooding. Long-term flooding can also pose a problem for attractive nuisances (birds and wildlife) and vectors (mosquitos). GHD recommends the County clarify what criteria for flood inundation elevation and duration would be appropriate for this project.

2.2.2 San Luis Obispo Creek

The ability of the storm drain system to discharge to San Luis Obispo Creek by gravity is dependent on the water surface elevation in the creek at the storm drain outfall. For gravity discharge to the creek, the hydraulic grade line in the storm drain system must be higher than the water surface elevation in the creek to overcome the hydraulic losses in the storm drain system, such as friction and losses at junctions, and also the hydraulic head required to open the duckbill check valve at the outfall. The outfall is located just upstream of the mouth of San Luis Obispo Creek and the water surface elevation in the creek at this location may be influenced by a combination of fluvial inputs (the flow in the creek), oceanic inputs, and the condition of a sand bar that sometimes forms at the mouth of the creek, restricting or eliminating outflow to the Pacific Ocean.

Fluvial Influence

San Luis Obispo Creek has a drainage area of 83.1 square miles (FEMA, 2017) and can experience significant flows during storm events which affect the water surface elevation of the creek at the storm drain outfall. Section 3.3 of the Conceptual Design Report refers to the Amendment to the Drainage Study for The Colony at Avila Beach (Cannon Associates, 2006) for the “hydraulic methodology associated with the existing duckbill and creek hydraulics” but does not state the hydraulic design criteria used. However, Sections 3.5, 3.6, and Appendix A of the report note that the 100-year water surface elevation (Base Flood Elevation) from the FEMA Flood Insurance Rate Map was considered for the analysis of the storm drain outfall in San Luis Obispo Creek. Depending on the level of flood risk reduction that the County would like to achieve for this project, considering the 100-year water surface elevation at the channel outfall may be appropriate or it may be too conservative.

Tidal Influence

The reach of San Luis Obispo Creek where the storm drain outfall is located is tidally influenced as it is immediately upstream of the mouth of the creek at the Pacific Ocean. Tidal fluctuations in the ocean propagate up the creek and affect the water surface elevation of the creek. Section 3.5 of the Conceptual Design Report discusses the tidal design criteria used for the study. While the report notes that tidal data from Port San Luis Station was used, it does not note what data was used for the design criteria, for example mean higher-high water, maximum tide, annual exceedance probability, etc.

Wave Influence

Section 3.5 of the Conceptual Design Report notes that a wave setup height of 2 feet above the tidal stillwater elevation was used for the analysis, although it is not clear how this was applied to the analysis. Given the location of the outfall, it may be protected from wave influence. This should be studied further.

Sandbar Influence

A sandbar periodically forms at the mouth of San Luis Obispo Creek, disconnecting it from the Pacific Ocean and cutting it off from tidal influence. As noted in the Conceptual Design Report, the formation of the sandbar may result in the outfall being submerged constantly, restricting the ability of the storm drain system to discharge to the creek. This may be an important design consideration because it could affect flooding at the project site beyond the fluvial and tidal influences. We recommend that the influence of the sandbar be considered as part of the design criteria for the project.

Sea Level Rise

The Conceptual Design Report does not mention consideration for future sea level rise. Sea level rise will likely exacerbate flooding at the project site by raising the water surface elevation in San Luis Obispo Creek at the outfall thereby reducing the amount of time that the storm drain system can drain by gravity. We recommend that sea level rise be considered as part of the design criteria for the project.

Coincident Influences

Depending on the scenario considered, the water surface elevation in the creek may be dependent on one or more of the factors listed above at a given time. However, these factors are not necessarily dependent on each other, for example, fluvial and tidal events are independent of each other. Section 3.6 of the Conceptual Design Report notes that a 100-year (1% annual chance exceedance) fluvial event was combined with tidal data to estimate the duration that the duckbill check valve at the outfall would be closed. It is not clear what tidal data was used for this analysis, but the information contained in Appendix A of the report suggests that a tidal cycle was developed using mean higher-high and mean lower-low water levels.

We recommend that the design criteria for the water surface elevation in San Luis Obispo Creek at the storm drain outfall consider coincident timing of the fluvial and tidal influences with appropriate recurrence intervals such that the likelihood of coincident occurrence is neither too frequent nor too infrequent. For example, considering a 1% annual chance exceedance fluvial event concurrent with a 1% annual chance exceedance tidal event is a very conservative approach.

2.2.3 Summary

A summary of the various design criteria that are believed to have been considered in the Conceptual Design Report as well as criteria that are recommended to be considered as part of the design is included in Table 1.

Table 1 Summary of Design Criteria

Project Component	Design Criteria	Criteria in Conceptual Design Report	Recommendation
Interior Drainage	Design Storm	24-hour storm with rainfall depth of 0.8 inches	Should be re-evaluated, a larger design storm should be considered
	Flood Inundation Elevation and Duration	Not included	Should be defined
San Luis Obispo Creek	Fluvial Influence	100-year water surface elevation	Should be re-evaluated
	Tidal Influence	Not clear	Should be defined
	Wave Influence	2 feet wave setup	Should be re-evaluated
	Sandbar Influence	Not included	Should be defined
	Sea Level Rise	Not included	Should be defined
	Coincident Influences	Not clear	Should be defined

2.3 Technical Analyses

2.3.1 Interior Drainage

Drainage Sub-basin Delineation

The Conceptual Design Report includes drainage sub-basins for the area in the vicinity of the project on Figure 2 and those are assumed to have been delineated using the topographic data shown on that figure. The analysis resulted in a drainage area of 21.5 acres for the storm drain system that drains to the project site. In general, the drainage sub-basins developed for that system seem to correspond with the topographic data. However, there appears to be a portion of San Luis Street that may drain down 1st Street (and not across it as shown in Figure 2) and therefore contribute runoff to the project area that was not included. It is recommended that the sub-basin delineation be evaluated to confirm the sub-basins for the project site.

Rainfall-Runoff Modeling

Rainfall-runoff modeling was conducted as part of the analysis included in the Conceptual Design Report to develop runoff hydrographs and volumes for the area that drains to the project site. The model was conducted using the HydroCAD software and an SCS Type 1 24-hour synthetic unit hydrograph. The 24-hour rainfall depths for storms with recurrence intervals of 5, 10, 25, and 100-years were obtained from NOAA Atlas 14, and "small storms" with 24-hour rainfall depths ranging from 0.1 inches to 1.0 inches were also modeled. For all storm events, the modeling assumed a time of concentration of 10 minutes and a curve number of 95 for the 21.5-acre drainage area.

The modeling approach is consistent with standard engineering practices. However, the assumed time of concentration of 10 minutes may be too short given the size of the sub-basin, and the assumed curve number of 95 is likely overly conservative as this assumes a completely impervious sub-basin, but there are some permeable surfaces within the sub-basin. It is recommended that the time of concentration and curve number be re-evaluated.

Flood Inundation Analysis of Existing Conditions

A flood inundation analysis was included in the Conceptual Design Report to estimate the depth of flooding for the existing conditions during the various storm events that were modeled. The analysis did not consider the runoff volumes for the entire 24-hour design storm but extracted volumes from the runoff hydrographs for the five-hour interval with the highest rainfall intensity. This was based on their determination that the duckbill check valve at the outfall would be closed for approximately five hours before allowing flow to discharge by gravity. This determination is discussed more in Section 2.3.2.

To estimate the flood inundation elevation, a stage-storage rating curve was developed for the parking lot, presumably based on the topographic data used for the study. The five-hour runoff volumes for the various design storms were compared to the parking lot stage-storage rating curve to estimate the flood inundation elevation for each storm event. While the approach of using runoff hydrographs and a stage-storage rating curve to estimate flood inundation elevations is appropriate, the determination that the duckbill check valve at the outfall would only be closed for five hours should be re-evaluated, as discussed more in Section 2.3.2.

Hydraulic Analysis of Existing Storm Drain System

The Conceptual Design Report discusses a hydraulic evaluation of the existing storm drain system in Section 3.6 and states:

> *After the five hour period [when the duckbill check valve at the outfall is closed], the creek elevation will lower enough for the outfall to partially flow. As the creek levels continue to drop, the flow of the outfall will continue to increase until it reaches its full flow of 39 cfs (at approximately 9 hours after the start of the cycle). By the time the creek levels rise again during the next high tide, the parking lot will have completely drained.*

Following the first 12 hour cycle, creek levels will be substantially lower and the 36" outfall will be able to keep pace with the storm inflow. Therefore, calculations for the second 12 hours were not developed since the flood volumes will be lower.

It is not clear what analysis was conducted to support the statement above, nor is it clear what design storm was considered for runoff to the storm drain system. It is also not clear how the full flow capacity of 39 cubic feet per second (cfs) was determined; it is assumed to have come from the Amendment to the Drainage Study for The Colony at Avila Beach (Cannon Associates, 2006), but it is not clear from that report how it was determined.

In addition, the graph included in Appendix A of the report showing the elevations in San Luis Obispo Creek conflicts with the statement that during the second 12 hours of the tidal cycle the outfall will be able to keep pace with the storm inflow. The graph shows the outfall being partially or fully submerged during this period of the tidal cycle with times of partial flow and no flow.

It is recommended that the hydraulic capacity of the existing storm drain system be further evaluated. A hydraulic model should be developed for the system that takes into account hydraulic head loss due to friction in the pipe, junctions, and the duckbill check valve.

Technical Analyses of Alternatives

The Conceptual Design Report does not include much with respect to technical analyses of the alternatives. A summary of what was included for each alternative is included below.

1. **Alternative #1 – Gravity System into Sewer System**

   The report states that a new 12-inch line would connect the storm drain system to the existing 8-inch sanitary sewer main in 1st Street but does not describe how the size of the pipe was determined, what its capacity would be, or how this would affect the hydraulics of the sanitary sewer system.

2. **Alternative #2 – Pumping Options**

   The report states that a pump with a capacity of 250 gallons per minute (gpm) "will drain the site in less than 15 hours based on the runoff volume generated during a 0.8 inch, 24-hr storm event", but does not provide analysis to support this statement.

3. **Alternative #3 – Standpipe**

   The report did not include any quantitative analysis of this alternative.

Although several design storms were evaluated for the existing condition, only a 24-hour storm with a rainfall depth of 0.8 inches was considered for Alternative 2. As discussed in Section 2.2.1 of this report, considering such a small rainfall event for the design of a facility intended to reduce flooding does not seem appropriate as it would likely provide a minimal reduction in flood risk.

Groundwater Impacts

The Conceptual Design Report discusses the presence of high groundwater at the site and its potential impact on flooding in the area. However, the analysis does not appear to account for any effects from groundwater on the analysis of the existing conditions or alternatives. In addition, sea level rise will likely contribute to higher groundwater elevations at the site. It is recommended that groundwater impacts at the project site be studied further.

2.3.2 San Luis Obispo Creek

The ability of the storm drain system to drain by gravity is dependent on the water level in San Luis Obispo Creek at the outfall. The analysis in the Conceptual Design Report considered coincident tidal and fluvial events for the flood inundation analysis of the existing conditions (see Section 2.3.1). Section 3.5 of the report notes that analysis for the duckbill check valve at the outfall to San Luis Obispo Creek being closed assumes that the "100-year peak flow will occur during high tide and dissipate in one tidal cycle". While the report does not discuss how the tidal cycle was

developed, it appears that a 24-hour tidal cycle was developed using mean higher-high and mean lower-low water levels. Based on this analysis, the report concludes that the duckbill check valve will be closed for approximately five hours.

There are several considerations with respect to this approach:

- Assuming that flow in San Luis Obispo Creek would only occur during one tidal cycle (approximately 12 hours) should be verified. Given the size of the watershed and the consideration for a 100-year storm event, it seems that there would likely be significant flow in the creek beyond this time period which could affect how long the duckbill check valve is closed.
- Assuming that the peak flow in the creek occurs at the high tide is not conservative when considering how long the duckbill check valve at the outfall will be closed. Since the report notes that the duckbill check valve will be closed during a significant portion of the tidal cycle, then offsetting the peak flow in the creek from the high tide would result in the duckbill check valve being closed for a longer period of time.
- There may be other coincident combinations of fluvial and tidal events that result in the duckbill check valve being closed for longer periods of time, such as a less frequent tidal event combined with a more frequent fluvial event.
- It is not clear how wave setup was taken into consideration for the analysis.

Section 7.0 of the Conceptual Design Report notes that the existing sandbar that forms at the mouth of the creek can disconnect the outfall from tidal influence and cause high water levels that backwater the storm drain system. This would impact the ability of the storm drain system to drain and conflicts with the analysis and statements in the report regarding the ability of the system to drain during lower periods of the tidal cycle. It does not appear that the formation of the sandbar was considered as part of the analysis.

Lastly, sea level rise was not a consideration in the analysis for the Conceptual Design Report and this will likely impact flooding at the project site in the future.

It is recommended that the water level in San Luis Obispo Creek be re-evaluated. The factors discussed above should be considered and the design criteria discussed in Section 2.2.2 should be re-evaluated or defined as needed.

2.4 Identified Alternatives

The Conceptual Design Report presents the following four alternatives for improvements to reduce flooding in the area:

1. **Alternative #1 – Gravity System into Sewer System**

   This alternative would connect the existing storm drain system to the existing sanitary sewer system in 1st Street. The connection would be controlled by a manually operated valve that would be opened when the parking lot is inundated to drain accumulated stormwater to the sanitary sewer system.

2. **Alternative #2 – Pumping Options**

   This alternative included three options for pumping accumulated stormwater from the flooded area. Ultimately, one option was carried forward that would install a pump at the parking lot that would discharge to a new outfall in San Luis Obispo Creek near the existing storm drain outfall.

3. **Alternative #3 – Standpipe**

   This alternative would install a standpipe above the MHHW tidal elevation on the exiting outfall pipe to allow water to outfall when the duckbill check valve on the outfall is closed.

4. **Alternative #4 – Parking Lot Reconstruction**

   This alternative would regrade the parking lot and 1st Street to reduce flooding and improve drainage. Ultimately, this alternative was determined to be unfeasible due to effects on adjacent private properties and utilities in the area.

In addition to these, other potential concepts that could have been considered include:

A. **Remove a Portion of the Parking Lot to Create Stormwater Detention Basin**

   This concept involves removing a portion of the parking lot to construct a stormwater detention basin to provide additional storage capacity to help reduce flooding extents. The basin would need to drain by gravity to the existing storm drain system, which limits the depth of the basin and high groundwater at the site may consume some of the storage capacity. This may not be a desired option as it would reduce parking capacity in the community which could have an economic impact on the businesses there.

B. **Install Underground Stormwater Storage Facilities in Parking Lot**

   This concept involves installing underground stormwater facilities within the parking lot to provide additional storage capacity to help reduce flooding extents. The facilities would need to drain by gravity to the existing storm drain system, which limits the depth of the facilities and high groundwater at the site may consume some of the storage capacity. However, this concept would preserve the existing parking capacity in the lot.

C. **Floodproofing**

   This concept involves floodproofing the existing buildings and key infrastructure in the area to provide protection against flooding without modifying the storm drain system. While this concept would not reduce flooding in the area, it would help protect facilities from it. However, access to the facilities would still be impacted from flooding.

D. **Redirect Runoff to Other Storm Drain Systems**

   This concept involves redirecting runoff from areas within the drainage sub-basin to other storm drain systems in the community with adequate capacity to reduce the flow to the project site. It would likely include installing inlets higher up in the sub-basin to collect runoff before it gets to the intersection of 1st Street and San Francisco Street. These inlets would connect to other existing storm drain systems with new pipe. The feasibility of this concept would need to be studied as the elevations of the existing storm drain systems may not allow this concept to provide much benefit. In addition, the capacities of the existing systems and potential for backflow (which could exacerbate flooding at the project site) would need to be evaluated.

E. **Incorporate LID Facilities within Drainage Sub-basin**

   This concept involves installing low impact development (LID) facilities within the drainage sub-basin to capture and infiltrate runoff to reduce the flow to the project site. These could include bioretention facilities, underground infiltration devices, and permeable pavement. These facilities would likely be installed within the public right-of-way and their effectiveness could be affected by high groundwater and infiltration rates, both of which would need to be evaluated.

2.5 Preferred Alternative

The Conceptual Design Report concluded that Alternative #1 – Gravity System into Sewer System was dependent on many factors and may require upgrades to the existing sanitary sewer conveyance system and the wastewater treatment plant. We agree with this assessment and also have concerns that this concept would be able to provide a significant reduction in flooding in the area during large storm events due to limited capacity of the sanitary sewer system.

The report concluded that Alternative #3 - Standpipe would provide “little to no benefit to the flooding problem”. We agree with this because water will discharge from the duckbill check valve when it is submerged, but the hydraulic

grade line in the storm drain system has to be high enough to overcome the head required to open the duckbill check valve. Installing a standpipe above the outfall still requires the hydraulic grade line in the storm drain system to rise to the level of the standpipe, which may actually be higher than the head required to open the duckbill check valve. In addition, this option only considers tidal influence at the outfall and not impacts on water surface in the creek from flow within the creek.

The report concluded that Alternative #4 – Parking Lot Reconstruction was unfeasible due to effects on adjacent properties and utilities in the area. We agree that raising the parking lot as a single solution would not reduce flooding at the intersection of 1st Street and San Francisco Street, in fact it could increase flooding in that area. It is not clear if the concept also included raising the intersection of 1st Street and San Francisco Street, which could reduce flooding in the area, but this would have major impacts on the adjacent properties and utilities in the area.

Given the information presented in the report, we agree with their conclusion that a pump station is the preferred alternative for reducing flooding at the project site. A system that relies on gravity to drain the site is limited by the water surface elevation in the creek, which can remain high and limit and prevent discharge for extended periods of time, resulting in the need for onsite storage to help reduce flooding. The parking lot along 1st Steet begins to flood when the water level in the swale along the north side of the parking lot reaches elevation 5.7 feet. Any gravity storm drain system that outlets to San Luis Obispo Creek is dependent on the water surface elevation in the creek being below this elevation to prevent flooding. However, the MHHW tidal elevation in San Luis Bay is 5.25 feet (NOAA, 2022), which is an average daily tidal condition that is regularly exceeded and is nearly at the elevation that would cause the parking lot to start flooding during a storm. In addition, the sandbar that forms at the mouth of the creek is expected to be higher than the MHHW elevation and could result in a water surface elevation in the creek at the storm drain outfall that is higher than the MHHW elevation when there is only base flow in the creek and no storm flow. When considering storm events that produce flow in San Luis Obispo Creek, the water surface elevation in the creek is much higher at the storm drain outfall, as demonstrated by the data in Table 2 from the FIS (FEMA, 2017).

Table 2 Water Surface Elevation in San Luis Obispo Creek at Storm Drain Outfall

Flood Event	Water Surface Elevation (ft)
10% Annual Chance Food (10-year Flood)	9.1
2% Annual Chance Food (50-year Flood)	12.3
1% Annual Chance Food (100-year Flood)	14.0

For these reasons, a gravity drainage system that discharges into San Luis Obispo Creek will only function under limited conditions. A stormwater pump station would be required to effectively reduce flood risk in the area during larger tidal and fluvial events.

However, as discussed above, only a small storm event (0.8 inches of rainfall in 24 hours) was evaluated for the proposed pump station and considering such a small rainfall event for the design of a facility intended to reduce flooding does not seem appropriate as it would likely provide a minimal reduction in flood risk. Designing the pump station for a larger storm event would further reduce flood risk and also require a larger pump and force main.

The conceptual drawing for the proposed pump station shows the force main crossing through private property near the corner of Avila Beach Drive and 1st Street. Since the concept was developed, a house has been built on that property so the force main would need to be realigned accordingly.

Lastly, the pump station would benefit from an emergency backup generator so that it can function during power outages, which are common during storms. The report does not discuss the need for a backup generator.

3. Project Goals

The County has identified the following goals for the project:

- Environmental and Permitting Goals: Consideration of a solution that will be feasible to construct and permit from the appropriate regulatory agencies
- Operation and Maintenance Goals: Consideration of a solution that will minimize O&M staff response and trash impacts to system
- Integrated Water Management Goals: Consideration of a solution that accounts for potential beneficial use of the water

4. Recommended Project

Based on our review of the Conceptual Design Report, other publicly available information for the project site, and the County's project goals, we recommend a stormwater pump station with a gravity bypass for reducing flood risk in the area of 1st Street and San Francisco Street. Conceptual drawings of the recommended project are included in Attachment 1. The conceptual drawings were developed with limited topographic, aerial imagery, and property line information that has not been verified and does not appear to be highly accurate. For example, the drawings show the existing County drainage easement and storm drain line passing through an existing building, which is not expected to be the case. More accurate topographic and property line information is needed to design the recommended project.

The proposed pump station would be installed in the southeast corner of the parking lot near the inlet to the existing storm drain system that drains the area to San Luis Obispo Creek. It would have an intake that connects to the existing swale the runs along the northwest side of the parking lot and flow would enter the pump station wet well through this inlet. Flow would be pumped from the pump station through a force main that would parallel the existing gravity storm drain line that drains the parking lot. The force main would pass from the parking lot through an existing 12-foot-wide County drainage easement (adjacent to the building that is currently occupied by Sinor La Vallee Estates Wines) and into 1st Street where it would turn to the west and cross Avila Beach Drive.

Once across Avila Beach Drive, the force main would discharge into a new junction structure that will connect the pump station system with the existing gravity storm drain system. Both the new force main and existing gravity line would discharge into this structure. The structure outlet would be the existing gravity line that discharges into San Luis Obispo Creek. A new flap gate would be installed in the discharge structure on the existing gravity inlet line to prevent backflow into the gravity system from the creek and from the force main discharge. This would eliminate the need for the existing duckbill check valve at the creek discharge, which would be removed.

The existing gravity storm drain system would remain in place and continue to function as it currently does, serving as a bypass to the pump station when conditions allow for it to function and providing redundancy in the system. When the water level in the swale along the northwest side of the parking lot reaches a certain elevation, it would overflow into pump station and the site would be drained by the pump station rather than the gravity system.

The pump station will need to be connected to electrical power. It is also recommended to have a backup generator, likely diesel powered, so that it can continue to function during power outages.

In addition to the pump station, the project could incorporate some of the features discussed in Section 2.4, such as underground stormwater storage facilities or LID facilities within the sub-basin to help provide additional storage and reduce flows to the pump station. These types of facilities could also help address the County's integrated water management goal by providing stormwater infiltration, resulting in reduce discharge from the site, groundwater recharge, and improved stormwater quality.

The recommended project is intended to meet the County's goals with the components presented in Table 3.

Table 3 Recommended Project with Respect to County Goals

County Goal	Recommended Project Benefit
Environmental and Permitting Goals: Consideration of a solution that will be feasible to construct and permit from the appropriate regulatory agencies	• utilizes the existing outfall in the creek and does not require a new one, which is expected to reduce environmental impacts and permitting requirements • little impact to the existing swale (likely a jurisdictional wetland), which is expected to reduce environmental impacts and permitting requirements
Operation and Maintenance Goals: Consideration of a solution that will minimize O&M staff response and trash impacts to system	• includes a gravity bypass system to reduce pump station O&M needs and costs • will have a backup generator to reduce staff response during a power outage • will have an intake separate from where the swale discharges to the gravity system, so two intakes may help reduce trash/debris loading at either intake by distributing it between both • trash rack at pump station will be more accessible than existing swale inlet • eliminates the duckbill valve in the creek and replace it with a flap gate in the discharge structure which is expected be easier to inspect and maintain
Integrated Water Management Goals: Consideration of a solution that accounts for potential beneficial use of the water	• potentially incorporate underground storage or LID facilities to store and infiltrate runoff, resulting in reduced discharge from the site, groundwater recharge, and improved stormwater quality

5. Data Gaps

There is very limited data currently available for the project and it is recommended that the following be completed before beginning the design phase:

- Conduct a field survey to obtain accurate existing conditions information in the vicinity of the project, including topographic data, locations of existing utilities, elevations of key hydraulic controls, and locations of existing surface features (buildings, fences, sidewalks, etc.)
- Obtain accurate locations for existing property lines and easements in the vicinity of the project
- Identify location and capacity of electrical service for pump station
- Obtain geotechnical data (including groundwater data) and recommendations for the project

Depending on the design criteria that is defined for the project, additional information may be required, including:

- Hydraulic data for San Luis Obispo Creek
- Tidal elevation data
- Elevation data on the sandbar at the mouth of the creek

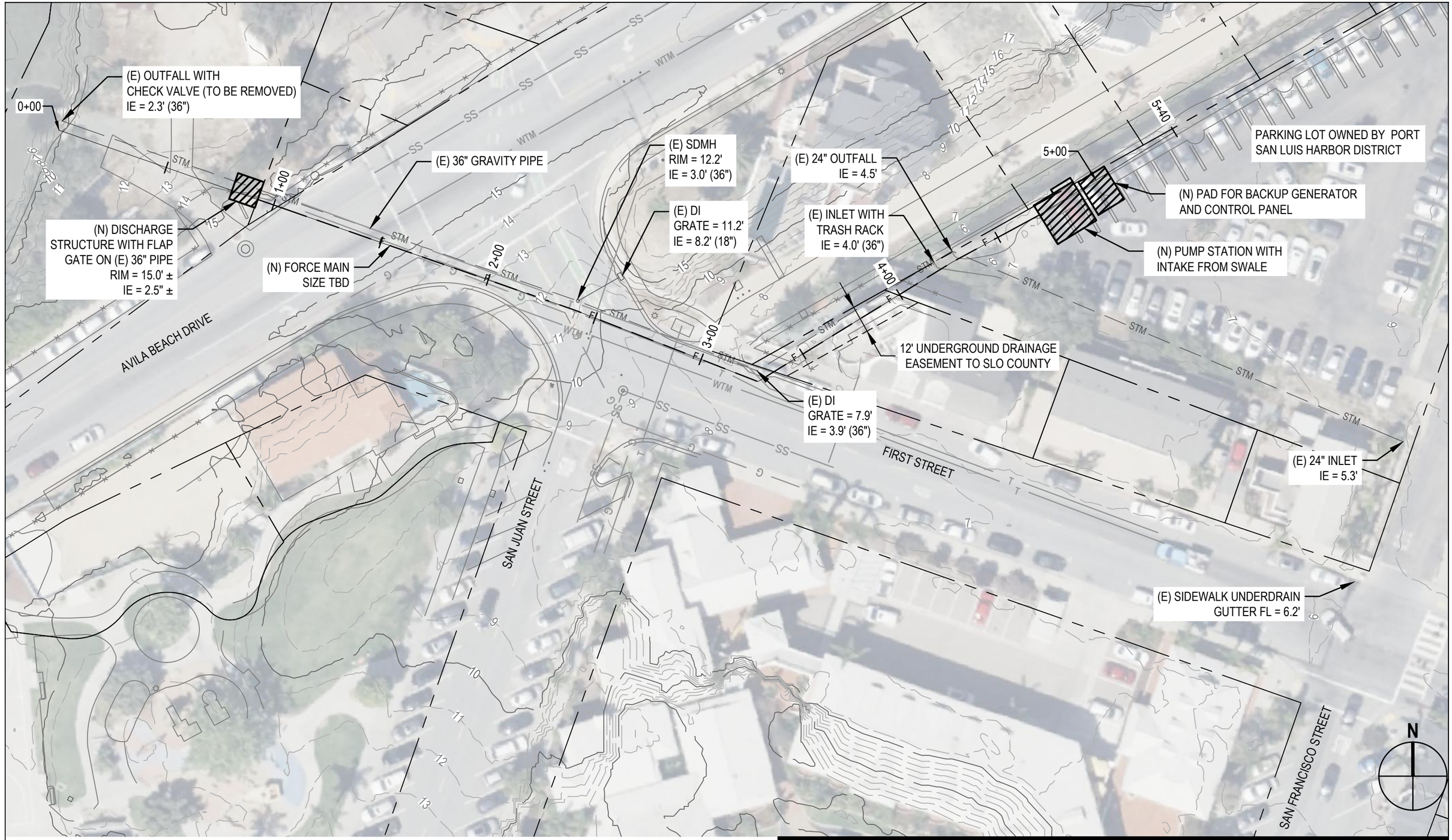
6. References

Cannon. (2015). *Avila Beach First Street Drainage - Conceptual Design Report.*
Cannon Associates. (2006). *Amendment to the Drainage Study for The Colony at Avila Beach.*
County of San Luis Obispo. (2017). Post Construction Requirements Handbook (Version 1.2).
FEMA. (2017). *Flood Insurance Study San Luis Obispo County, Calfiornia.*
NOAA. (2022, October 25). *Datums for 9412110, Port San Luis CA*. Retrieved from Tides & Currents: https://tidesandcurrents.noaa.gov/datums.html?id=9412110

Attachments

Attachment 1

Conceptual Drawings for Recommended Project



NOTES:

1. EXISTING CONTOURS SHOWN WERE GENERATED FROM 2018 FEMA LIDAR DATA, THIS DATA HAS NOT BEEN VERIFIED.
2. STORM DRAIN ELEVATIONS SHOWN ARE FROM 2015 CONCEPTUAL DESIGN REPORT PREPARED BY CANNON, THIS DATA HAS NOT BEEN VERIFIED.
3. PARCEL BOUNDARIES PROVIDED BY PARCEL QUEST FOR SLO COUNTY.
4. EXISTING UTILITIES WERE APPROXIMATED BASED ON RECORD PLANS FROM THE SLO COUNTY PUBLIC WORKS PLAN INDEX.

0 20' 40' 80'

GHD

COUNTY OF SAN LUIS OBISPO
AVILA BEACH FIRST STREET DRAINAGE

RECOMMENDED PROJECT CONCEPTUAL PLAN

Project No. **12596287**
Date **11/10/2023**

FIGURE 1

Filename: \\ghdnet\ghd\US\San Luis Obispo\Projects\561\12596287\Digital_Design\ACAD\Figures\12596287-FIG-Recommended Concept.dwg
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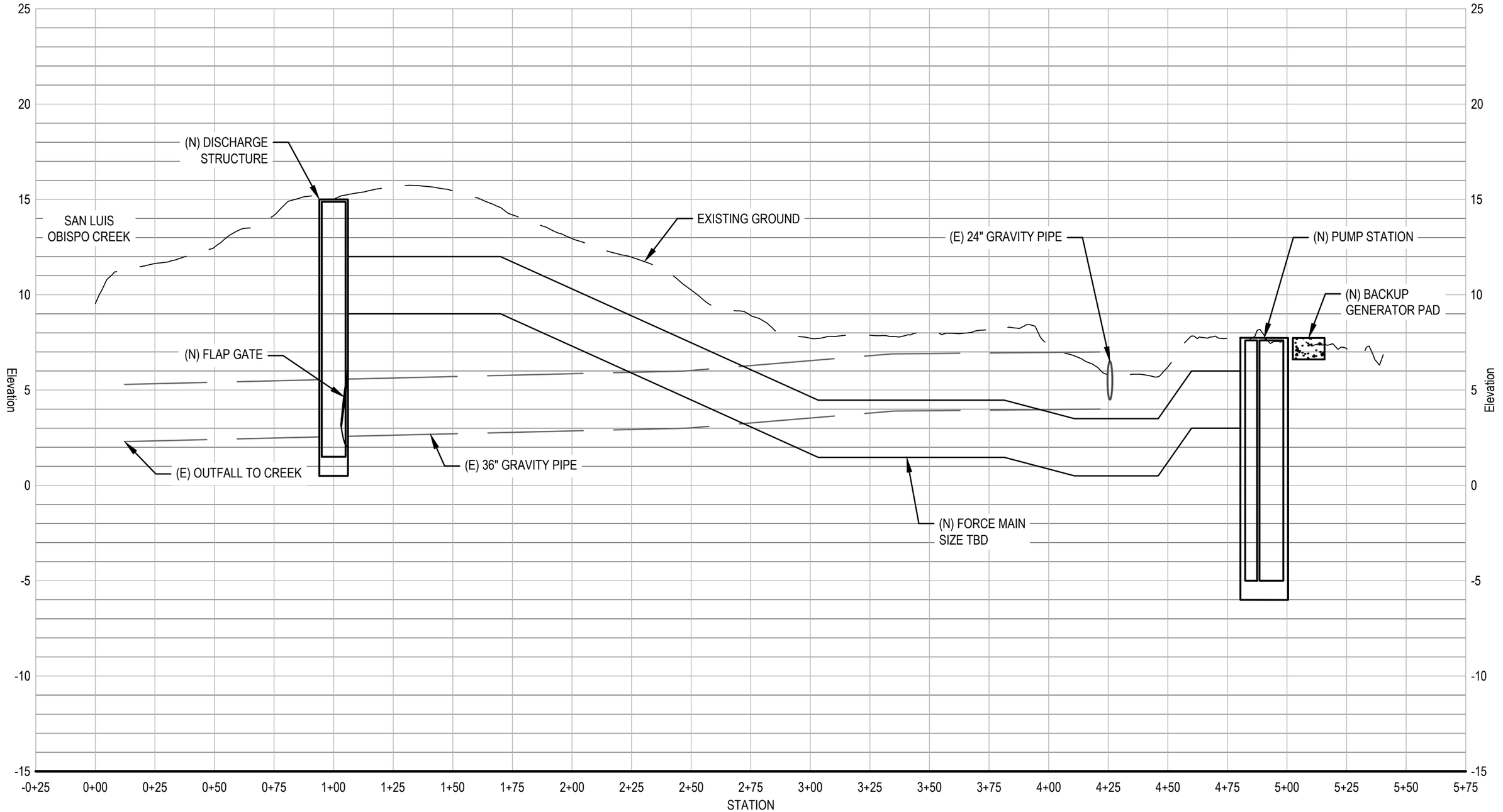
Data Source



1 PROPOSED FORCE MAIN PROFILE
SCALE H: 1" = 40', V: 1" = 5'

NOTES:
1. EXISTING GROUND SHOWN WAS GENERATED FROM 2018 FEMA LIDAR DATA, THIS DATA HAS NOT BEEN VERIFIED.
2. EXISTING STORM DRAIN ELEVATIONS SHOWN ARE FROM 2015 CONCEPTUAL DESIGN REPORT PREPARED BY CANNON, THIS DATA HAS NOT BEEN VERIFIED.

0 20' 40' 80'

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COUNTY OF SAN LUIS OBISPO
AVILA BEACH FIRST STREET DRAINAGE

RECOMMENDED PROJECT CONCEPTUAL PROFILE

Project No. 12596287
Date 11/10/2023

FIGURE 2

Data Source

Filename: \\ghdnetghd\US\San Luis Obispo\Projects\561\12596287\Digital_Design\ACAD\Figures\12596287-FIG-Recommended Concept.dwg
Plot Date: 10 November 2023 12:39 PM


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