City of Trinidad
ASBS Stormwater Improvements Project

Initial Study and Draft Mitigated Negative Declaration

November 2013

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1. *has been prepared by GHD for the City of Trinidad;*

2. *may only be used and relied on by the City of Trinidad and applicable regulatory agencies;*

3. *may only be used for the purpose of CEQA compliance for the project (and must not be used for any other purpose).*

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The services undertaken by GHD in connection with preparing this Report:

- *were limited to those specifically detailed in this Report;*

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Project # 01063-11005-11001

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1. Project Information

Project Title	City of Trinidad ASBS Stormwater Improvement Project
Lead Agency Name & Address	City of Trinidad 409 Trinity Street Trinidad, CA 95570
Contact Person	Ms. Karen Suiker, City Manager Phone number: (707) 677-3876 Email: citymanager@trinidad.ca.gov
Project Location	The project is located within the city limits of the City of Trinidad, west of Highway 101, in Humboldt County, California.
Project Assessor's Parcel Numbers (APN)	Multiple APN's and ROWs within the city limits of the City of Trinidad.
General Plan Designation	Primarily public ROW (undesignated), city-wide
Zoning	Primarily public ROW (unzoned), city-wide
Description of Project	The City of Trinidad Area of Special Biological Significance (ASBS) Stormwater Improvement project has been designed to collect, treat, and infiltrate City stormwater runoff. This will be accomplished by modernizing the City stormwater system through incorporation of Low Impact Development Best Management Practices (LID/BMPs) to capture, treat, and infiltrate stormwater runoff.

1.1 CEQA Requirements

This project is subject to the requirements of the California Environmental Quality Act (CEQA). The CEQA lead agency is the City of Trinidad. The purpose of this Initial Study is:

1. to provide a basis for deciding whether to prepare an Environmental Impact Report, a Mitigated Negative Declaration or a Negative Declaration;
2. to disclose potential project environmental impacts; and
3. to inform the CEQA Lead Agency, responsible agencies, trustee agencies, and the public of the project and potential environmental impacts.

This Initial Study has been prepared to satisfy the requirements of the CEQA, (Public Resources Code, Div. 13, Sec 21000-21177), and the State CEQA Guidelines (California Code of Regulations, Title 14, Sec 15000-15387). CEQA encourages lead agencies to modify their projects to avoid significant adverse impacts.

1.2 Background

The City of Trinidad (City) is undertaking the Trinidad Area of Special Biological Significance (ASBS) Stormwater Improvement Project (project) to reduce polluted runoff into the ASBS. The design of the new stormwater system was developed to collect, treat, and infiltrate City stormwater runoff, thus improving stormwater quality that reaches Trinidad Bay. The project will assist the City in meeting the requirements of the California Ocean Plan's prohibition of waste discharge into the Kelp Beds at Trinidad Head ASBS. The project objectives are in line with the goals of local programs like the Trinidad-Westhaven Coastal Watershed Management Plan, which was initiated to improve local water quality and protect ecosystems including the Trinidad ASBS.

The project is located within the City limits of the City of Trinidad, on the west side of Highway 101 in Humboldt County, California (Figure 1, Vicinity Map). The City is located in rural northern California, approximately 25 miles (highway) north of the county seat of Eureka and 295 miles (highway) north of San Francisco. The community has a population of approximately 1,000 people with approximately 365 people living within the City limits (California Department of Finance 2013).

Much of the urban area overlies a fairly uniform sand aquifer, above a low permeability Franciscan melange (bedrock). The project area is bounded by Mill Creek to the North; Parker Creek to the East; Highway 101 to the Northeast; and coastal bluffs, the Pacific Ocean, and Trinidad Bay to the west and south (Figure 1). The project site is defined as the construction footprint (plus 10 foot setback in each direction) for all LID stormwater improvements.

Trinidad Bay is designated as an ASBS. There are 34 ocean ASBS areas monitored and maintained for water quality by the State Water Resources Control Board (SWRCB). ASBS cover much of the length of California's coastal waters. They support an unusual variety of aquatic life, and often host unique individual species.

The 'Trinidad Head' ASBS runs approximately two miles (in total length) near Trinidad Bay in the City of Trinidad as shown in Figure 1. Rural and urban watersheds discharge to this ASBS. Trinidad Bay has seasonal marina facilities (i.e., a mooring field, vessel haul-out/launch facilities, and pier facilities), and Humboldt State University Marine Lab is located within the City limits. The ASBS is bordered by an emergent coastline of hard rock which becomes visible as the sandstone and mudstone are worn away by wind and waves (California SWRCB 2013).

The long term goal of the City is to protect the ASBS by eliminating the existing storm drain outfall to Trinidad Bay and improving the City's stormwater system. Phase 1 of this project (the project) will modernize the stormwater system through incorporation of Low Impact Development Best Management Practices (LID/BMPs) to capture, treat, and infiltrate stormwater runoff. Phase 2, which is not a part of this project, and would be implemented at a later date subject to available funding, would potentially eliminate the need for the existing stormwater outfall to Trinidad Bay.

1.3 Environmental Setting and Existing Conditions

The project is within Sections 23 and 26, Township 8 North, Range 1 West, Humboldt Meridian within the USGS 7.5' Trinidad topographic quadrangle map at approximately 40 feet above sea level to 175 feet above sea level (Figure 1). Access to the project area is via Highway 101 exit Main Street/Westhaven Drive South, then head west on Main Street into Trinidad. The project is within the California Coastal Zone in the City of Trinidad primary jurisdiction and Coastal Commission appeal jurisdiction (reference Section 3.10 for additional information).

This project area encompasses two watersheds: the Mill Creek and City of Trinidad watersheds (Figures 1 and 3). The Mill Creek watershed is bisected by Highway 101 but otherwise is primarily forested with minimal development. Currently, stormwater that accumulates in the northern portions of town drain into Mill Creek, which discharges near Trinidad State Beach approximately 500 feet north of the ASBS. Approximately 20% of the City's stormwater currently drains to Mill Creek. The City of Trinidad watershed encompasses most of the City, the surrounding coastal bluffs, and Trinidad Head. The stormwater system collects much of the stormwater that accumulates within Trinidad and discharges it directly to the ASBS through discharge TRI032 (Figure 1). Approximately 80% of the City's stormwater currently drains to this outfall.

Surrounding land uses include residential homes, commercial and public/quasi-public uses interspersed throughout the community. The Pacific Ocean is to the west and south. Humboldt County General Plan land use designations to the north of the project area consist of Public Recreation, Commercial General, Rural Residential, and to the east consist of Rural Residential and Residential Estates.

1.4 Project Description

1.4.1 Project Objectives

Objectives of the project include:

- To collect, treat, and infiltrate City stormwater runoff;
- To reduce polluted stormwater discharge from the City to the ASBS for storms up to the 50-year event. Stormwater discharge will be reduced through the implementation of LID/BMPs installed throughout the City;
- To meet the requirements of the California Ocean Plan's prohibition of waste discharge into the Kelp Beds at Trinidad Head ASBS;
- To minimize the project's impacts to environmental resources.

1.4.2 Project Construction Components

The design process began with a review of commonly implemented LID technologies to ascertain appropriate technologies for the project. LID technology selection criteria consisted of: 1) ability to treat, store, or infiltrate stormwater, 2) fit within the existing City right-of-way (ROW), 3) minimize reduction of City parking, 4) minimize operation and maintenance requirements, and 5) remain within budget. Reference Figure 2 for stormwater improvements for the proposed project. LID technologies for the proposed project include:

Underground Infiltration Basins

Underground infiltration basins allow collected stormwater to be stored underground and percolate into the soil. They are typically constructed of pre-fabricated concrete or plastic units that are connected together and backfilled with gravel, most of which can be installed below streets or parking lots and are capable of supporting traffic loads. Once installed, underground infiltration basins take up no space on the surface, and can handle runoff from large rain events by storing water underground and allowing it to percolate into the soil over time, allowing for groundwater recharge. Reference Figure 2 for the location of infiltration basins.

Rain Gardens

Stormwater can be stored, treated, and infiltrated through rain gardens. Rain gardens are constructed as depressions in the ground, which fill with rainwater during a storm event and allow the water to percolate into the ground and soil. Nutrients, metals, sediment, and other common stormwater contaminants become trapped in the rain garden soil and are eventually taken up by the plants as they grow. Rain gardens are typically constructed on roadsides, in parking lots, traffic islands, private yards, and other areas. Two rain gardens are proposed for this project (Figure 2). One at the tennis court and another at the intersection of Hector Street and Underwood Drive.

Bio-Swales

Bio-swales are engineered, vegetated channels which collect, convey, treat, store, and infiltrate stormwater. They are very effective at removing sediment by trapping suspended particles as stormwater flows through the vegetation, which acts like a filter. Bio-swales also help remove other contaminants and can store and infiltrate stormwater similar to rain gardens. Reference Figure 2 for the location of bio-swales.

Permeable Pavers

Permeable paving systems allow surfaces to be walked or driven on and stormwater to infiltrate through them, decreasing runoff. Permeable paver systems are typically constructed of concrete blocks or interlocking plastic geo-tiles which allow grass or other vegetation to grow between or through them. Such systems are typically constructed in parking lots or walkways where vehicle speeds are expected to be low and are used as an alternative to asphalt or concrete paving. The City recently installed a fire access road to the Trinidad Museum using a vegetated permeable paving system. Permeable paving is described in more detail on the following page.

Design Plan

The design plan is to intercept stormwater upstream of the Trinidad Bay outfall and channel it via bio-swales, the existing stormwater collection system, and new stormwater pipes to the rain gardens and infiltration basins located throughout the City where it can percolate into the soil, contributing to groundwater recharge. Stormwater treatment would occur through physical and biological activity associated with the rain gardens and bio-swales in compliance with California Stormwater Quality Association (CASQA) requirements. Locations for the proposed improvements were strategically selected based on the existing topography, available open spaces within the City ROW, and proximity to coastal bluffs to avoid potential detrimental impacts to bluff stability. The proposed stormwater system would allow stormwater to be infiltrated at various locations dispersed throughout the City. In the event that a large storm event overloaded the system, excess runoff would flow to the Pacific Ocean via overland flow and through Mill Creek and Parker Creeks on the outskirts of Trinidad, as would naturally occur if the area were undeveloped.

Infiltration chambers were sized using an infiltration basin model developed using Microsoft Excel to simulate inflow, storage, and infiltration over a 24-hour storm event. The model uses runoff data generated by the hydrologic (HEC-RAS) model to calculate the anticipated quantity of water collected by the new storm drain system which would flow to each infiltration basin. The Green-Ampt equation was used to determine the rate of infiltration based on hydraulic head and advancement of the saturated soil front at each time step. Soil permeability and depth to bedrock were based on values determined during the geotechnical investigations. The model uses mass balance calculations to determine the volume of stormwater stored in each chamber, which reached maximum values as the hydrographs peaked. The calculated storage volumes were input into an online infiltration basin sizing calculator, which would output the required infiltration basin area, which was then input back into the basin sizing to generate a new required storage volume value. Sizing of the infiltration basins was iteratively optimized in this manner to balance available infiltration area with storage volume. This analysis was performed for storm sizes ranging up to the 50-year - 24 hour storm events. Infiltration basin model and sizing results are included in Appendix B.

Street side bio-swales were designed to capture stormwater and route it to underground infiltration basins while providing treatment, infiltration and some storage. The swales were designed to gently slope towards a storm drain inlet at the low end of the swale, which is slightly elevated to allow the swale to store a small amount of stormwater. Once enough water accumulates and the water level rises, it flows into the storm drain system that collects water from other nearby bio-swales and routes it to an underground infiltration chamber constructed beneath the swales. The surfaces of the bio-swales are designed with permeable pavers with vegetation to stabilize the channel and allow vehicles to park on them.

The site at the corner of Hector Street and Underwood Drive was identified as a suitable location for a rain garden as shown in Figure 2. Stormwater runoff flowing down adjacent streets would be channelled by curbs and gutters and low asphalt humps into the rain gardens. Stormwater entering the gardens will flow into a small area that will allow sediment to settle out prior to flowing into the main rain garden area. During large storm events, rain gardens are designed to fill then overflow to a nearby storm drain which channels the water to underground infiltration chambers. Native plant species and soil mixtures which optimize stormwater nutrient and contaminant removal will be selected for planting.

The proposed bio-swales and rain gardens will help remove sediment, nutrients and other contaminants. Additional actions will also be implemented to remove sediment as described below. Water quality testing has found sediment loading in stormwater in the project area. Excessive sediment entering underground infiltration chambers will cause them to clog over time, reducing their ability to infiltrate. Therefore, each infiltration chamber will be equipped with a sedimentation basin at the inlet which will allow sediment to settle out prior to the water entering the infiltration chamber. A cleanout located above these sedimentation chambers will allow periodic removal of collected silts and grit. The number of sedimentation chambers was minimized during the preliminary design phase to reduce required maintenance.

The design also features modifications to the existing tennis court parking lot on Trinity Street. The parking lot is currently paved with conventional asphalt paving which drains to the gutter along Trinity Street. Proposed modifications involve constructing a rain garden at the back of the lot (adjacent to the tennis court), reversing the parking lot slope to drain from Trinity Street to the proposed rain garden, and paving the parking lot with vegetated, permeable pavers to allow stormwater to infiltrate as it flows toward the rain garden. Parking lot safety would also be improved by routing the sidewalk around the parking lot such that pedestrians would be directed to walk adjacent to the rain garden, in front of parked cars, rather than behind them, as is currently the case. The rain garden would be constructed at a lower level than the adjacent sidewalk and would be surrounded by concrete retaining walls with inlets to allow stormwater to enter from the parking lot. A storm drain inlet located in the rain garden would connect to the infiltration basins underneath Trinity Street via pipes for large storm events.

Collection system piping was sized using the Environmental Protection Agency's (EPA) Stormwater Management Model (SWMM). Smooth walled high-density polyethylene (HDPE) pipe has been selected for the piping system.

The MODFLOW-SURFACT groundwater model was used to simulate stormwater infiltration below ground at the proposed underground infiltration basin locations to verify that the area could accommodate increased infiltration without detrimental impacts to streams, septic systems and bluff stability. Groundwater model outputs were reviewed by GHD and by registered engineering geologists at Crawford & Associates, Inc. and HydroGeoLogic, Inc. to verify that the locations and quantities of stormwater infiltration will not impact the performance of septic systems, compromise bluff stability, or cause significant changes to flows in nearby streams. Technical memorandums from both Crawford & Associates, Inc. and HydroGeoLogic, Inc. describing their findings are included in Appendix C and Appendix D, respectively.

Access and Staging

Access to and from the project site would be primarily from Highway 101 via Main Street. The project improvements would be primarily within existing road ROW and, as such, would not require the development of new access routes. The storage of construction materials and vehicle staging would be managed entirely within existing developed areas and/or other suitable public areas within the project area. As required to construct the project, temporary staging areas may also be established within other public and/or private properties on or near the improvement areas, but would not be established within or adjacent to any sensitive species or habitat. The proposed staging area for this project is an undeveloped parcel at the northeast corner of View Avenue and Parker Creek Drive. This parcel has been used as a staging area for other construction projects in the past.

1.4.3 Construction Schedule, Techniques and Equipment

Project construction is anticipated to start in the spring/summer of 2014 and expected to be completed in five to eight months. All construction will occur either beneath city streets or along the sides of city streets, within the public right-of-way or on City-owned property. Traffic control will be a major component of this project, as City streets are reduced to one lane of travel or temporarily closed during construction. The majority of the construction work will include pavement sawcutting, trenching, excavation and backfill to install storm drain improvements including storm drains, pipes, infiltration basins, drainage swales, rain gardens and permeable paved areas. Typical earth moving and compaction equipment would be the majority of equipment used, including bulldozers, excavators, backhoes, and rollers. Other equipment and vehicles used would include dump trucks, concrete trucks, paving equipment, portable generator sets, and various power and hand-tools.

Construction activities would be conducted in compliance with applicable state and local requirements and in a manner that minimizes disturbance to adjacent properties and disruption to traffic. Construction would generally occur between the hours of 7:00 AM and 7:00 PM, Monday through Friday. No construction would occur on weekends, except with permission from the City as needed to keep the project on schedule. It is anticipated that between eight and 10 construction workers (includes two flaggers) will be present on the project site at any given time. The number of motor vehicles is anticipated to be up to 10. The project would also require the delivery of equipment, workers, and materials via Main Street from Highway 101.

1.5 Agencies Involved

Responsible Agencies: Other Public Agencies Whose Approval Is Required

Agencies with Permit Jurisdiction

City of Trinidad – Coastal Development Permit & Encroachment Permit

North Coast Regional Water Quality Control Board (RWQCB) – Storm Water Pollution Prevention Plan (SWPPP)

Coastal Commission – Coastal Development Permit (only if appealed)

Other Stakeholder Agencies: CEQA Trustee Agencies and Endangered Species Consultation Agencies

- California Department of Fish and Wildlife
- North Coast Regional Water Quality Control Board
- National Oceanic Atmospheric Administration National Marine Fisheries Service
- United States Fish and Wildlife Service
- North Coast Air Quality Management District
- State Water Resources Control Board
- California Coastal Commission
- California Department of Parks and Recreation

1.6 Environmental Protection Actions Incorporated into the Project

The following environmental protection actions and practices are included as part of the project to reduce or avoid potential adverse effects that could result from construction or operation of the LID/BMP stormwater improvements. Additional resource-specific environmental protection actions are presented in the following analysis sections. Project and resource-specific mitigation measures are also included in the Mitigation, Monitoring, and Reporting Plan prepared for the project (Appendix A).

1.6.1 Environmental Protection Action 1 – Implement Air Quality Emission Control Measures during Construction

Although the North Coast Unified Air Quality Management District (NCUAQMD) has not adopted formal construction measures or guidelines, the project includes the following air quality control actions to reduce construction-generated emissions:

The principal concern about the effect of construction projects on air quality relates to the potential for earthwork and other activities to generate dust, including inhalable particulate matter (PM_{10}) that poses a human health hazard. To address the potential for dust generation, the contractor will be required to implement the following BMPs, which are based on the Bay Area Air Quality Management District's (BAAQMD's) *Feasible Control Measures for Construction Emissions of PM_{10}* (BAAQMD 1999). These actions will also apply to ground disturbing maintenance activities and equipment exhaust.

- Exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) will be watered as necessary during dusty conditions.
- If loose material becomes airborne during transportation, haul trucks transporting soil, sand, or other loose material off-site will be covered.
- Disturbed roadways will be re-paved as soon as possible following work in the area, as appropriate.
- Visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers, as necessary. The use of dry power sweeping is prohibited.
- Idling times will be minimized by shutting equipment off when not in use.
- Construction equipment will be maintained and properly tuned in accordance with manufacturer's specifications.

1.6.2 Environmental Protection Action 2 – Procedures regarding Encountering Human Remains

If human remains are discovered during project construction, work will stop at the discovery location within 20 meters (66 feet), and any nearby area reasonably suspected to overlie adjacent to human remains (Public Resources Code, Section 7050.5). The Humboldt County Coroner will be contacted to determine if the cause of death must be investigated. If the coroner determines that the remains are of Native American origin, it is necessary to comply with state laws relating to the disposition of Native American burials, which fall within the jurisdiction of the Native American Heritage Commission (NAHC) (Public Resources Code, Section 5097). The coroner will contact the NAHC. The descendants or most likely descendants of the deceased will be contacted, and work will not resume until they have made a recommendation to the landowner or the person responsible for the excavation work for means of treatment and disposition, with appropriate dignity, of the human remains and any associated grave goods, as provided in Public Resources Code, Section 5097.98. Work may resume if NAHC is unable to identify a descendant or the descendant fails to make a recommendation.

1.6.3 Environmental Protection Action 3 – Erosion Control

The following erosion control actions shall be implemented by the construction contractor to prevent soil erosion and sedimentation during construction. Erosion and sediment control actions will be in effect and maintained by the contractor on a year-round basis until all disturbed areas are stabilized.

- Stockpiled material will be covered as necessary.
- Fiber rolls or similar products will be utilized in appropriate locations to reduce sediment runoff from disturbed soils, as necessary.
- Storm drain inlets receiving stormwater runoff will be equipped with inlet protection, as necessary.
- A concrete washout area will be designated to clean concrete trucks and tools, as necessary.

1.6.4 Environmental Protection Action 4 – Construction Dewatering Reduction

Excavation and below grade work will be scheduled during summer/fall to coincide with the period of the lowest groundwater levels at the site and the timeframe with the least chance for rainfall. If groundwater is encountered, the contractor, in coordination with the City will evaluate options for dewatering management. If dewatering is necessary, one or more of the following management options shall be used by the construction contractor to protect water quality:

- Reuse the water on-site for dust control, compaction, or irrigation, as appropriate.
- Retain the water on-site in a grassy or porous area to allow infiltration/evaporation.
- Discharge (by permit) to a sanitary sewer or storm drain (this option may require a temporary method to filter sediment-laden water prior to discharge).

If discharge to a storm drain (i.e., surface waters) is the only feasible option, the project will comply with Water Board requirements for construction dewatering. Actions may include characterizing the discharge and receiving waters and developing a BMP Plan including filtering methods, monitoring and reporting requirements, and a description of the pump systems proposed to remove groundwater and maintain a dry work area.

1.6.5 Environmental Protection Action 5 – Noise Reduction Actions

During project construction, the following actions will be incorporated into the project to reduce daytime noise impacts to the maximum feasible extent:

- A preconstruction meeting (or conference call) will be held among the City of Trinidad, construction manager, and the general contractor to confirm that the following noise reduction practices are to be implemented in the appropriate phase of construction.
- Hours of construction will typically be limited to between 7:00 AM to 7:00 PM, Monday through Friday. No construction would occur on weekends except with permission from the City as needed to keep the project on schedule.
- Semi-stationary equipment (e.g., generators, compressors, etc.) will be located as far as possible from residences.

- Quietest available equipment and electrically-powered equipment will be used, rather than internal combustion engines where feasible.
- Equipment and on-site trucks used for project construction will be equipped with properly functioning noise control devices such as mufflers, shields, and shrouds. All construction equipment will be inspected by construction personnel at periodic intervals to ensure proper maintenance and resulting lower noise levels.
- Impact tools (e.g., jack hammers, pavement breakers, rock drills) used for project construction will be hydraulically or electrically powered wherever possible to avoid noise associated with compressed-air exhaust from pneumatically powered tools.

Humboldt County
Counties
Watershed Boundary
Area of Special Biological Significance (ASBS)
Project Area
Trinidad City Limits

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

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City of Trinidad
ASBS Stormwater Improvements Project
Initial Study and Mitigated Negative Declaration

Job Number	0106311005
Revision	1
Date	24 Sep 2013

Vicinity Map

Figure 1

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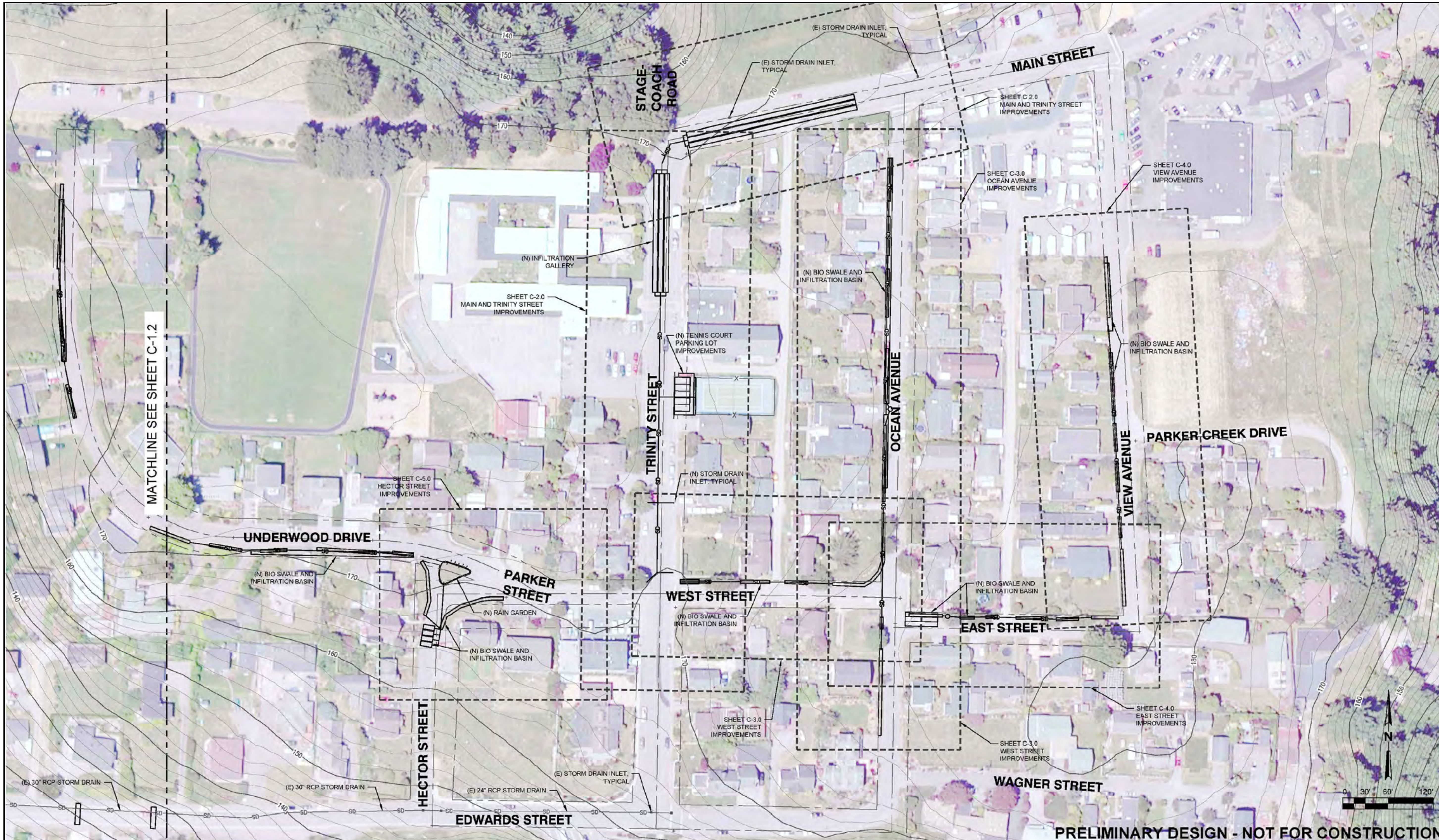
718 Third Street Eureka, CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Data source: StreetMapUSA, Roads, Boundaries, 2010. Bing Aerials, Aerial Imagery, 2012. City of Trinidad, Area of Special Biological Significance, 2011. Humboldt County, Watersheds, 2011. Created by:amshows



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City of Trinidad
ASBS Stormwater Improvements Project
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ASBS Stormwater Improvements Project

Figure 2

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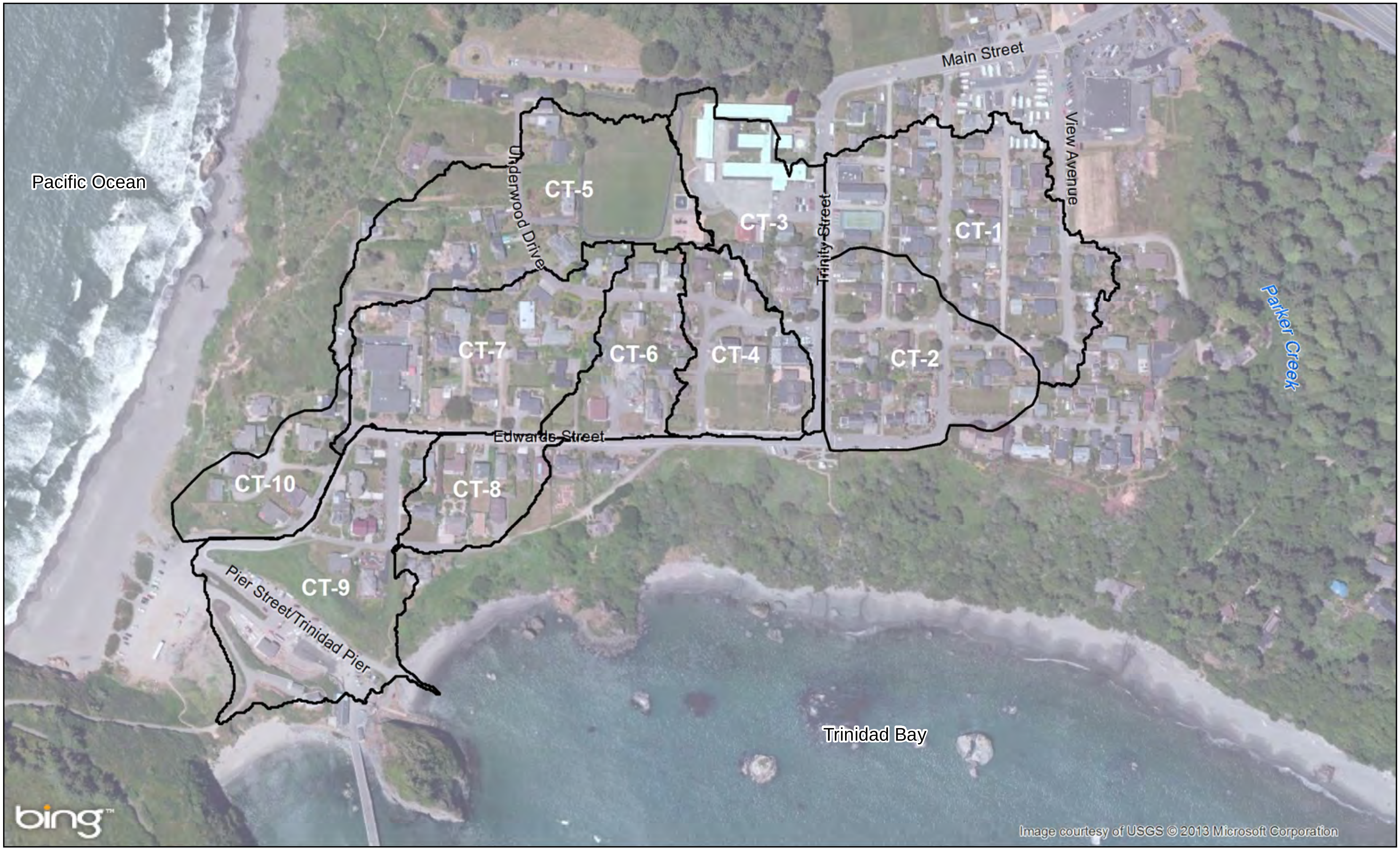
718 Third Street Eureka, CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:amshows



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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
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City Sub-Basins

City of Trinidad
ASBS Stormwater Improvements Project
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Job Number	0106311005
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Date	23 Sep 2013

City Watershed Sub-Basins

Figure 3

\\ghdnet\ghd\US\Eureka\Projects\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\F5_City_Watersheds.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:amshows

2. Environmental Factors Potentially Affected

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Greenhouse Gas Emissions	☐ Population/Housing
☐ Agricultural & Forestry Resources	☐ Hazards & Hazardous Materials	☐ Public Services
☐ Air Quality	☐ Hydrology/Water Quality	☐ Recreation
☐ Biological Resources	☐ Land Use/Planning	☐ Transportation/Traffic
☐ Cultural Resources	☐ Mineral Resources	☐ Utilities/Service Systems
☐ Geology/Soils	☐ Noise	☐ Mandatory Findings of Significance

DETERMINATION

(To be completed by the Lead Agency) On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect: (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect: (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed Project, nothing further is required.

[signature] 11/18/13

Signature City Planner Date
City of Trinidad

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3. Environmental Effects of the Project

3.1 Aesthetics

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Have a substantial adverse effect on a scenic vista?			✓	
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?				✓
c) Substantially degrade the existing visual character or quality of the site and its surroundings?			✓	
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?				✓

3.1.1 Discussion:

Views in Trinidad are exceptional in every direction. To the west and south views include the Pacific Ocean, Trinidad Head, coastline and offshore rocks. The Memorial Lighthouse can be seen from Edwards Street and Trinity Street. Views to the north and east include dense forest, mountains, and rural residential development.

Construction will primarily be limited to within existing public road ROW in the streets west of Highway 101 within the City limits of Trinidad. Reference Figure 2 for streets proposed for LID/BMP stormwater improvements. Project activities would be seen by residents and visitors of Trinidad during construction. Post construction, some of the stormwater improvements will not be visible such as the infiltration basins and galleries and underground storm drain systems. Visible elements post construction, include bio swales, the rain garden, and the Trinity Street tennis court parking lot improvements, which will have minor visual impacts.

The project would include only minor temporary obstructions or changes to the visual environment related to construction. Subsurface construction would be accomplished through open-cut trenching methods, which upon site restoration would not be noticeably different from pre-project conditions except for the areas to receive bio swales and rain gardens. Visible elements of the project would likely include temporary stationary and mobile heavy equipment and vehicles, materials storage and staging, workers, and disturbances to the ground surface and roads. These visual changes may be expected to last for the duration of construction, which would occur relatively rapidly in any one location as the project improvements are completed. The primary staging area may experience noticeable visual temporary changes for the duration of the project.

a) Adverse Effect on a Scenic Vista – Less than Significant Impact

The project area contains important coastal views. Views of the ocean, coastal foothills, and other visual resources in the Trinidad area may be temporarily altered by equipment, construction materials, and workers during active construction in any given section of the project site. The changes to the views would be minor, temporary, and would generally be visible only to the public in the immediate vicinity of the active portion of construction. Upon completion of the project, there would not be readily discernible alterations to the visual nature of the area or any obstructions to scenic vistas other than the bio swales, rain garden, and Trinity Street tennis court parking lot. Vegetation used in the bio-swales and rain gardens will include native forbs and small shrubs such as sticky monkey flower (*Mimulus aurantiacus*), western azalea (*Rhododendron occidentale*), Douglas iris (*Iris douglasiana*), tufted hairgrass (*Deschampsia cespitosa*), and broad-leaf lupine (*Lupinus polyphyllus*) up to approximately three to four feet in height. The impact would be less than significant.

b) Damage Scenic Resources within a State Scenic Highway – No Impact

Based on California Scenic Highway Mapping System information, no designated state scenic highways are found adjacent to or within view of the project area (California Department of Transportation 2013). There are no officially designated State Scenic Highways within Humboldt County, although Highway 101 for its entire length in Humboldt County has been identified by the State Scenic Highway Mapping System as eligible for state listing. The project area is visible from Highway 101; however, due to the project's minor, isolated and temporary nature of construction, no impact has been identified.

c) Degrade Existing Visual Character – Less than Significant Impact

As discussed previously, construction activities associated with the project would result in minor temporary aesthetic impacts that would not substantially alter the visual character of the project area. Construction activities associated with the project are anticipated to start in the spring/summer of 2014 and expected to be completed in five to eight months. The ground surface, where disturbed, would be restored to pre-project conditions following construction (excluding the bio-swales and rain gardens). The visual character in and around the project area would not be substantially degraded. Though subjective, most people would consider the LID stormwater improvements including bio swales and rain gardens to be more aesthetically pleasing than current conditions. Therefore, this would be a less than significant impact.

d) New Source of Light or Glare – No Impact

Construction of the project would occur during daylight hours, and operation of the project would not require lighting to be installed. No new permanent lighting is proposed. As a result, there would be no new source of substantial light or glare; therefore, there would be no impacts.

3.2 Agriculture and Forest Resources

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				✓
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				✓
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?				✓
d) Result in the loss of forest land or conversion of forest land to non-forest use?				✓
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?				✓

3.2.1 Discussion

There is no agricultural land or agricultural uses in or around Trinidad. However, there is a significant amount of commercial and non-commercial forest land, including land designated as Timberland Production Zone (TPZ), in upland areas east of Trinidad.

a) Convert Important Farmland – No Impact

Though California's Farmland Mapping and Monitoring Program has not mapped Humboldt County, agriculture is still extremely important in the region. However, Trinidad and its planning area do not contain agriculturally zoned land or known agricultural uses other than small private horse pastures. Soils in the project area are generally very sandy with high percolation rates that would not be considered 'Prime' soils. The project would not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to a non-agricultural use; therefore, no impact would occur.

b, c) Conflict with Existing Zoning for Agricultural Use or Forest Land – No Impact

The project sites are generally within public ROW, and the surrounding areas are primarily zoned Urban Residential with the following additional zoning designations: Open Space, Special Environment, Planned Development, Commercial, Visitor Services and Public and Religious. There are no parcels in the project area under Williamson Act contract

(California Department of Conservation 2010). There is land zoned TPZ within the City's Planning Area, but none near the project sites; the commercial timberland is located east of Hwy 101 and the rural residential areas near the coast. The project would not conflict with agricultural or forest land zoning or Williamson Act contracts. No impact would occur.

d, e) Convert Forest Land or Farmland – No Impact

No forest land or timberland exists within the project area. The project would not result in the loss or conversion of forest land, or involve other changes in the existing environment which would result in conversion of farmland to non-agricultural use or conversion of forest land to non-forest use. No impacts would occur.

3.3 Air Quality

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?			✓	
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?			✓	
c) Result in a cumulatively considerable net increase in any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?			✓	
d) Expose sensitive receptors to substantial pollutant concentrations?			✓	
e) Create objectionable odors affecting a substantial number of people?			✓	

3.3.1 Discussion

The project area is located within the North Coast Air Basin (NCAB), which is under the jurisdiction of the NCUAQMD. The NCAB is comprised of three air districts, the North Coast Unified AQMD, the Mendocino County AQMD, and the Northern Sonoma County APCD. The North Coast Unified AQMD includes Del Norte, Humboldt, and Trinity Counties. The NCAB currently meets all federal air quality standards; however, the entire air basin is currently designated as non-attainment for the state 24-hour and annual average particulate matter smaller than 10 microns in size (PM10) standards. The air basin is designated as unclassified for the state annual PM2.5 standard – available data are insufficient to support designation as attainment or non-attainment. Both natural and anthropogenic sources of particulate matter (including vehicle emissions, wind generated dust, construction dust, wildfire and human caused wood smoke, and sea salts) in the NCAB have led to the PM10 non-attainment designation.

a) Conflict with or Obstruct Applicable Air Quality Plan – Less than Significant Impact

To address non-attainment for PM10, the NCUAQMD adopted a Particulate Matter Attainment Plan in 1995. This plan presents available information about the nature and causes of PM10 standard exceedances and identifies cost-effective control actions to reduce PM10 emissions to levels necessary to meet California Ambient Air Quality Standards. The Draft Noise and Safety Element of the Trinidad General Plan (December 2012) includes policies to continue to cooperate with the NCUAQMD: to review new projects for consistency with NCUAQMD regulations and guidelines; adopt a plan and timeline to reduce greenhouse gas emissions for City operations through the establishment and implementation of a Greenhouse Gas Reduction Action Plan or Climate Action Plan; and to include dust control provisions in the Grading Ordinance.

The project would generate a minor amount of particulate emissions over the duration of construction in the form of dust and vehicle emissions as a result of earthwork, trenching, paving, and other construction activities. However, due to the small area that will be disturbed (0.8 acres) and the short time of construction (5-8 months), dust generation will not be significant. The project would not cause any long-term increase in the emissions of particulate matter of other air pollutants. To reduce potential impacts to air quality, standard construction BMPs, including several environmental protection actions consistent with the NCUAQMD Particulate Matter Attainment Plan that would substantially reduce dust and other air pollutants during the construction period have been incorporated into the project as specified in Section 1.6, Environmental Protection Actions Incorporated into the Project. While the NCAB is in non-attainment for PM10, the temporary nature of construction activities combined with project implementation of standard dust and CO2 emission reduction actions during construction would avoid significant impacts.

In the long term, the project would not substantially add to the level of PM10 or other emissions such that it would cause a cumulatively considerable net increase of pollutant emissions in the area. With implementation of BMPs and Environmental Protection Actions incorporated into the project, the project would not obstruct implementation of the NCUAQMD particulate matter attainment plan. The project would also be consistent with applicable City General Plan policies related to air resources and a less than significant impact would occur.

b) Violate Air Quality Standard or Contribute Substantially to Existing or Projected Air Quality Violation – Less than Significant Impact

Under the federal Clean Air Act of 1977, the US EPA is required to identify National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. The EPA has established NAAQS for six criteria air pollutants (Carbon Monoxide, Lead, Nitrogen Dioxide, Ozone, Particle Pollution and Sulfur Dioxide), but the NCAB does not exceed these federal pollutant thresholds. Under the California Clean Air Act, the California Air Resources Board (CARB) has adopted more stringent standards for the criteria air pollutants. Though it has adopted a particulate matter attainment plan, the NCUAQMD has not established specific thresholds of significance for criteria pollutants. As discussed above, the NCAB is currently designated as a state non-attainment area for suspended particulate matter (PM10), but does not violate other federal, state, or local air quality standards (CARB 2012). In the NCAB, most particulate matter is caused by vehicle emissions, wind generated dust, construction dust, wildfire and human caused wood smoke, and sea salts. Health effects from particulate matter include reduced lung function, aggravation of respiratory and cardiovascular diseases, increases in mortality rate, and reduced lung function and growth in children.

Project construction activities would cause the release of a small amount of PM10 emissions related to fugitive dust, exhaust emissions from on-road haul trucks, worker commute vehicles, and off-road heavy duty construction equipment; however, because of the relatively small footprint and duration of the proposed construction, and with air pollution prevention BMPs incorporated into the project (see Section 1.6, Environmental Protection Measures Incorporated into the Project) construction of the project would not cause a violation of air quality standards or contribute substantially to an existing or projected air quality violation. Long-term operation of the project would cause only a negligible release of air quality pollutants because most of the improvements would be underground and would require little maintenance, or would not be capable of releasing air quality pollutants at all. A less than significant impact would occur.

c) Result in Cumulatively Considerable Net Increase of Any Criteria Pollutant for which the Region is in Non-Attainment – Less than Significant Impact

As described above, the NCAB is in non-attainment for the criteria air pollutant PM10; however, as discussed above, with incorporation of Environmental Protection Action 1, project construction would cause only minor and short-term production of PM10 and would not significantly increase the background levels. Project operation would result in negligible additional PM10 emissions. Therefore, the project would result in a less than significant cumulative impact to air quality from criteria air pollutant and precursor emissions.

d) Expose Sensitive Receptors to Substantial Pollutant Concentrations – Less than Significant Impact

Construction of the project would create temporary emissions of toxic air contaminants, primarily as a component of diesel emissions. Due to the variable nature of construction activity, the generation of toxic air contaminant emissions in most cases would be temporary, particularly considering the short amount of time such equipment is typically within an influential distance of sensitive receptors. Sensitive receptors in the project area include residences, churches, bed and breakfasts, and any areas adjacent to roadways where the general public would have access. Concentrations of mobile-source diesel PM emissions are typically reduced by 70 percent at a distance of approximately 500 feet (BAAQMD 2012). In addition, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9, 40, and 70 years, which do not correlate well with the temporary and highly variable nature of construction activities associated with this project.

Construction is anticipated to occur over approximately five to eight months between the hours of 7:00 AM and 7:00 PM, Monday through Friday. As discussed above, the project would result in only minor, short-term construction-related air emissions. Additionally, the implementation of Environmental Protection Action 1, would keep diesel PM exhaust emissions at lower levels. As these emissions are temporary in nature, health risks from project construction are not anticipated. Construction impacts are less than significant.

Project operation would not expose sensitive receptors to substantial pollutant concentrations as the project does not include any stationary source emissions and the majority of LID/BMP stormwater improvements will be located underground. Therefore, no operational impacts would occur.

e) Create Objectionable Odors – Less than Significant Impact

During construction the various diesel-powered vehicles and equipment could create localized odors. Additionally, some materials used in construction or substrates encountered in sub-surface construction may create objectionable localized odors. These odors would be temporary and not likely to be noticeable for extended periods of time beyond the construction zone due to atmospheric dissipation. The impact would be less than significant.

Project operation would not expose a substantial number of people to objectionable odors as the project components are passive and would not include anything which would cause long-term objectionable odors. Therefore, no impact would occur.

3.4 Biological Resources

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?			✓	
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?			✓	
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?			✓	
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?				✓
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				✓
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?				✓

3.4.1 Discussion

The project activities are primarily within existing public road ROW or immediately adjacent to the ROW within the streets of Trinidad west of Highway 101. The LID/BMPs will capture, treat, and infiltrate stormwater runoff, thus reducing pollutants entering the existing stormwater outfall (TR1032) to Trinidad Bay. The project area can be described as predominantly urban (low density) with a few vacant parcels, and forest land at the periphery (and well beyond the project site and biological study area). The project site is located in the Trinidad USGS 7.5' quadrangle. A *California Natural Diversity Database* (CNDDB) and CNPS *Inventory of Rare and Endangered Vascular Plants* record search (Appendix E) was conducted for the Trinidad USGS 7.5' Quadrangle and adjacent quadrangles (Arcata North, Tyee City, Crannell, and Rodgers Peak) on August 6, 2013. Lists of potentially present federally listed species were also consulted for the Trinidad USGS 7.5' quadrangle (U.S. Fish and Wildlife Service [USFWS] Arcata Field Office, August 6, 2013) (Appendix F). These queries reported 32 special-status species with potential to occur in the Trinidad quadrangle and adjacent quadrangles (Table 3.1).

On August 13, 2013, a habitat evaluation was conducted to determine whether the project boundary contains habitat for special-status plants or animals. The survey boundary consists of Ocean Avenue, East Street, portions of West Street, Hector Street, all of Underwood Drive, Edwards Street, Galindo Street, Van Wycke Street and Lighthouse Road as well as the potential staging area within the parking lots for Trinidad Head and/or the Seascape Restaurant and Pier (Figures 1-3). To allow for temporary impact areas and possible minor variation in final design to avoid existing utilities, sections of Underwood Drive and Hector Street were also surveyed 10 feet off the edge of pavement within the ROW. The southern end of Galindo Street, 20 feet off the edge of pavement, was included in the habitat assessment. The habitat evaluation did not include roads where project activities are planned but are proposed strictly within bounds of existing pavement, such as Trinity Street and a portion of Parker Street.

Evaluation of the project site determined the area to be an urban setting with impervious surfaces, landscaped gardens, and small patches of non-native grasses. The project staging area, east of View Avenue and north of Parker Creek Drive, is a previously disturbed, now vacant, mixed-use zoned lot comprised of non-native shrubs and non-native herbaceous plants.

Table 3.1: Sensitive Species With Potential To Occur within the Project Boundary

Scientific Name	Common Name	Status	Preferred Habitat	Potential Habitat
Reptiles				
Rhyacotriton variegatus	southern torrent salamander	S2S3	Lower montane coniferous forest, Old growth, Redwood, Riparian forest	No suitable habitat present
Ascaphus truei	Pacific tailed frog	S2S3	Aquatic, Klamath/North coast flowing waters, Lower montane coniferous forest, North coast coniferous forest, Redwood, Riparian forest	No suitable habitat present
Rana aurora	northern red-legged frog	S2	Klamath/North coast flowing waters, Riparian forest, Riparian woodland	*Suitable habitat present*
Birds				
Oceanodroma furcata	fork-tailed storm-petrel	S1	Protected deep water coastal communities	No suitable habitat present
Phalacrocorax auritus	double-crested cormorant	S3	Riparian forest, Riparian scrub, Riparian woodland	No suitable habitat present
Charadrius alexandrinus nivosus	western snowy plover	FT, S2	Great Basin standing waters, Sand shore, Wetland	No suitable habitat present
Cerorhinca monocerata	rhinoceros auklet	S3	Protected deep water coastal communities	No suitable habitat present
Fratercula cirrhata	tufted puffin	S2	Protected deep water coastal communities	No suitable habitat present
Fish				
Oncorhynchus clarkii clarkii	coast cutthroat trout	S3	Aquatic, Klamath/North coast flowing waters	No suitable habitat present
Spirinchus thaleichthys	longfin smelt	ST	Aquatic, Estuary	No suitable habitat present
Eucyclogobius newberryi	tidewater goby	FE	Aquatic, Klamath/North coast flowing waters, Sacramento/San Joaquin flowing waters, South coast flowing waters	No suitable habitat present
Mammals				
Arborimus albipes	white-footed vole	S2S3	North coast coniferous forest, Redwood, Riparian forest	No suitable habitat present
Arborimus pomo	Sonoma tree vole	S3	North coast coniferous forest, Old growth, Redwood	No suitable habitat present
Vegetation				
Sphagnum Bog	Sphagnum Bog	S1.2	Bog & fen, Wetland	No suitable habitat present
Sitka Spruce Forest	Sitka Spruce Forest	S1.1		No suitable habitat present
Plants				
Abronia umbellata var. *breviflora*	pink sand-verbena	List 1B.1	Coastal dunes	*Suitable Habitat Present.*

Scientific Name	Common Name	Status	Preferred Habitat	Potential Habitat
Carex arcta	northern clustered sedge	List 2B.2	Bogs and fens, North Coast coniferous forest(mesic)	No suitable habitat present
Carex lenticularis var. *limnophila*	lagoon sedge	List 2B.2	Bogs and fens, Marshes and swamps, North Coast coniferous forest/shores, beaches; often gravelly	No suitable habitat present
Carex leptalea	bristle-stalked sedge	List 2B.2	Bog & fen, Freshwater marsh, Marsh & swamp, Meadow & seep, Wetland	No suitable habitat present
Carex lyngbyei	Lyngbye's sedge	List 2B.2	Marshes and swamps(brackish or freshwater)	No suitable habitat present
Carex saliniformis	deceiving sedge	List 1B.2	Coastal prairie, Coastal scrub, Meadows and seeps, Marshes and swamps(coastal salt)/mesic	*Suitable Habitat Present.*
Carex viridula var. *viridula*	green yellow sedge	List 2B.3	Bogs and fens, Marshes and swamps(freshwater), North Coast coniferous forest(mesic)	No suitable habitat present
Castilleja ambigua var. *humboldtiensis*	Humboldt Bay owl's-clover	List 1B.2	Marshes and swamps(coastal salt)	No suitable habitat present
Castilleja litoralis	Oregon coast paintbrush	List 2B.2	Coastal bluff scrub, Coastal dunes, Coastal scrub/sandy	*Suitable Habitat Present.*
Castilleja mendocinensis	Mendocino Coast paintbrush	List 1B.2	Coastal bluff scrub, Closed-cone coniferous forest, Coastal dunes, Coastal prairie, Coastal scrub	*Suitable Habitat Present.*
Chloropyron maritimum ssp. *palustre*	Point Reyes bird's-beak	List 1B.2	Marshes and swamps(coastal salt)	No suitable habitat present
Discelium nudum	naked flag moss	List 2B.2	Coastal bluff scrub(soil, on clay banks)	No suitable habitat present
Empetrum nigrum	black crowberry	List 2B.2	Coastal bluff scrub, Coastal prairie	*Suitable Habitat Present.*
Erigeron bloomeri var. *nudatus*	Waldo daisy	List 2B.3	Lower montane coniferous forest, Upper montane coniferous forest/serpentinite	No suitable habitat present
Erysimum menziesii	Menzies' wallflower	SE FE List 1B.1	Coastal dunes	*Suitable Habitat Present.*

Scientific Name	Common Name	Status	Preferred Habitat	Potential Habitat
Fissidens pauperculus	minute pocket moss	List 1B.2	North Coast coniferous forest(damp coastal soil)	No suitable habitat present
Gilia capitata ssp. *pacifica*	Pacific gilia	List 1B.2	Coastal bluff scrub, Chaparral(openings), Coastal prairie, Valley and foothill grassland	*Suitable Habitat Present.*
Gilia millefoliata	dark-eyed gilia	List 1B.2	Coastal dunes	No Suitable Habitat Present.
Juncus interior	inland rush	List 2B.2	Pinyon and juniper woodland	No suitable habitat present
Juncus nevadensis var. *inventus*	Sierra rush	List 2B.2	Bog & fen, Wetland	No suitable habitat present
Lathyrus japonicus	seaside pea	List 2B.1	Coastal dunes	*Suitable Habitat Present.*
Lathyrus palustris	marsh pea	List 2B.2	Bogs and fens, Coastal prairie, Coastal scrub, Lower montane coniferous forest, Marshes and swamps, North Coast coniferous forest/mesic	*Suitable Habitat Present.*
Layia carnosa	beach layia	SE FE List 1B.1	Coastal dunes, Coastal scrub(sandy)	*Suitable Habitat Present.*
Lilium occidentale	western lily	SE FE List 1B.1	Bogs and fens, Coastal bluff scrub, Coastal prairie, Coastal scrub, Marshes and swamps(freshwater), North Coast coniferous forest(openings)	*Suitable Habitat Present.*
Lycopodiella inundata	inundated bog club-moss	List 2B.2	Bogs and fens(coastal), Lower montane coniferous forest(mesic), Marshes and swamps(lake margins)	No suitable habitat present
Moneses uniflora	woodnymph	List 2B.2	Broad-leafed upland forest, North Coast coniferous forest	No suitable habitat present
Oenothera wolfii	Wolf's evening-primrose	List 1B.1	Coastal bluff scrub, Coastal dunes, Coastal prairie, Lower montane coniferous forest/sandy, usually mesic	*Suitable Habitat Present.*
Scientific Name	**Common Name**	**Status**	**Preferred Habitat**	**Potential Habitat**

Packera bolanderi var. *bolanderi*	seacoast ragwort	List 2B.2	Coastal scrub, North Coast coniferous forest/Sometimes roadsides	No suitable habitat present
Piperia candida	white-flowered rein orchid	List 1B.2	Broad-leafed upland forest, Lower montane coniferous forest, North Coast coniferous forest/sometimes serpentinite	No suitable habitat present
Polemonium carneum	Oregon polemonium	List 2B.2	Coastal prairie, Coastal scrub, Lower montane coniferous forest	*Suitable Habitat Present.*
Romanzoffia tracyi	Tracy's romanzoffia	List 2B.3	Coastal bluff scrub, Coastal scrub/rocky	No suitable habitat present
Sidalcea malviflora ssp. *patula*	Siskiyou checkerbloom	List 1B.2	Coastal bluff scrub, Coastal prairie, North Coast coniferous forest/often roadcuts	*Suitable Habitat Present.*
Sidalcea oregana ssp. *eximia*	coast checkerbloom	List 1B.2	Lower montane coniferous forest, Meadows and seeps, North Coast coniferous forest	No suitable habitat present
Trichodon cylindricus	cylindrical trichodon	List 2B.2	Broad-leafed upland forest, Meadows and seeps, Upper montane coniferous forest/sandy, exposed soil, roadbanks	No suitable habitat present
Viola palustris	alpine marsh violet	List 2B.2	Bogs and fens(coastal), Coastal scrub(mesic)	No suitable habitat present

KEY:	Source: CNDDB/USFWS/CNPS Trinidad 7.5' USGS Quadgrangle and five adjacent quadrangles
FEDERAL--U.S. Fish and Wildlife Service (USFWS)	
FE - Federal Endangered	
FT - Federal Threatened	
FC - Federal Candidate for listing	
FSC - United States Fish and Wildlife Service Federal Species of Special Concern	
STATE--California Department of Fish and Wildlife (CDFW)	
SE - State Endangered	
ST - State Threatened	
CSC - CDFW Species of Special Concern	
SLC - Species of Local Concern	
CFP - California Fully Protected Species	
California State Ranking	
S1= Critically Imperiled—Critically imperiled in the state because of extreme rarity (often 5 or fewer populations).	
S2= Imperiled - Imperiled in the state because of rarity due to very restricted range, very few populations (often <20 or fewer).	
S3= Vulnerable- vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent widespread declines, or other factors making it very vulnerable to extirpation from the state.	
S4= Apparently Secure- uncommon but not rare in the state; some cause for long-term concern due to declines or other factors.	
S5=Secure-common, widespread, and abundant in the state.	

California Native Plant Society (CNPS) California Rare Plant Ranks
1A- Presumed Extirpated in California and either Rare or extinct elsewhere
1B - Rare, Threatened, or Endangered in California and elsewhere
2 - Rare, Threatened or Endangered in California, but more common elsewhere
2A- Plants Presumed Extirpated in California, but more common elsewhere
2B- Plants Rare, Threatened, or Endangered in California, but more common elsewhere
3 - Review List (more information needed)
4 - Watch List (limited distribution in California)
Threat Ranks:
_0.1 Seriously threatened in California
_0.2 Moderately threatened in California
_0.3 Not very threatened in California

a) Impacts to Special-Status Species – Less than Significant Impact

Adjacent to the habitat assessment boundary and not within the project site, coastal dunes are present. During pre-survey investigations, the CNDDB scoping list indicates eight special-status plant species that are associated with or near coastal dune or coastal scrub habitat. Project activities avoid direct impacts to dune habitat and thus to potentially present associated listed plant species.

Additionally, the CNDDB scoping list identified nine special-status plant species that can be associated with coastal terrace/meadow (*Festuca rubra* Herbaceous Alliance). Evaluation of the project area on August 13, 2013, by a GHD Botanist and an Ecologist determined that potential habitat for special-status coastal terrace/meadow species is not present as the site consists of urbanized streetscapes, residential landscaping, impervious surfaces, and gravel lots. The existing commercial lot that is currently used for staging, at the northeast corner of View Avenue and Parker Creek Drive, is dominated by greater than 90% non-native grassland species. Therefore it is highly unlikely that these special-status plant species associated with coastal terrace/meadow would be present at the project site. Mitigation is not proposed and the impact is less than significant.

b) Riparian or Sensitive Natural Community – Less than Significant Impact

The project area near the Trinidad State Beach access is within proximity to coastal dunes. These areas are dominated by non-native ice plant (*Carpobrotus edulis* Semi Natural Herbaceous Stands) with patches of coyote brush and various native and non-native grasses. The Coastal Commission may consider these sand substrate areas to be Environmentally Sensitive Habitat Areas (ESHA), although areas with 100% cover of ice plant would not return to natural community without human intervention/restoration. Project activities will not impact this area; therefore, the impact is less than significant.

c) Wetlands – Less than Significant Impact

A habitat assessment survey was conducted within the project area on August 13, 2013, by a GHD Botanist and an Ecologist. No creeks or wetlands were identified within the project site; therefore, the project impact to creeks or wetlands is less than significant.

d) Movement of Fish or Wildlife Species – No Impact

The project would not substantially interfere with the movement of native resident or migratory fish or wildlife species or within established native resident or migratory wildlife corridors. No native wildlife nursery sites exist at the project site; however, there is the potential for nesting birds in the project vicinity, but not within the project construction footprint. There would be no permanent above ground barriers to movement associated with the project, the project will not affect stream flows in creeks, and construction disturbance would be limited to relatively small and discontinuous areas for a short period of time. No impact would occur.

e) Conflict with Local Policies or Ordinances – No Impact

The Trinidad Local Coastal Program (LCP) include several policies that apply to biological resources, including among others: protection of riparian vegetation within 100 feet of major coastal streams, development of Trinidad Head should be kept to a minimum, and protection of existing rare plants. These policies apply on all project lands subject to City of Trinidad jurisdiction and the project is in compliance with these policies. The project site is not within 100 feet of any major coastal stream. No impact would occur.

f) Habitat Conservation Plan – No Impact

The City of Trinidad does not have an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved conservation plan. No impact would occur.

3.5 Cultural Resources

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?		✓		
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?		✓		
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?		✓		
d) Disturb any human remains, including those interred outside of formal cemeteries?			✓	

3.5.1 Discussion

The project area has a rich cultural past including pre-historical use centered on the food resources of the ocean, and more recently based on commercial and sport fishing and recreational opportunities presented by the accessible coastline. Although the project will not cause demolition of any structures, there may be cultural artifacts on or below the surface that could be disturbed by the project.

The proposed project location is situated on a landform sensitive for Native American cultural resources with several documented Yurok ancestral sites in the vicinity. Historic-period map and air photo analysis suggests the location was adjacent to the original settlement area of Trinidad (Roscoe and Associates 2013).

a, b) Historical or Archaeological Resources – Less than Significant with Mitigation

An Archaeological Survey Report was prepared by Roscoe and Associates for the proposed project and because archaeological and other heritage resources can be damaged or destroyed through uncontrolled public disclosure, the report is available for review at the City of Trinidad, located at 409 Trinity Street. The cultural resource survey was designed to (1) locate and record cultural resources within the project area; (2) evaluate the significance of study area cultural resources, if present; (3) assess potential impacts to cultural resources, if present, resulting from implementation of the proposed project, and (4) recommend appropriate mitigation measures, if necessary.

According to the survey report, the Area of Potential Effect (APE) comprises the extent of ground-disturbing activities required for project construction. The project sites are primarily underground and do not affect the setting and feeling of the built environment. Because no buildings are affected, the built environment of the study area was not evaluated as part of the survey report.

The field survey investigation consisted of an intensive pedestrian field survey of the project APE. The purpose of the surfaces survey was to identify early Native American or historic era artifacts, features, and sites if present. The complete systematic intensive archaeological survey was conducted by Roscoe & Associates on September 10 and September 27, 2013. All visible ground surfaces were inspected for prehistoric and historic archaeological site indicators. Much of the project area was paved street. Nevertheless, about 5% of the surface area was visible. Even though the APE was mostly paved over, nearby open areas within the City's ROW were surveyed for archaeological indicators that might suggest the presence of significant cultural resources in the APE.

A records search was conducted by Roscoe & Associates at the Northwest Information Center (NWIC) Sonoma State University in Sonoma California on September 9, 2013. The records search and literature review revealed no previously recorded archaeological sites within the APE. The project APE has been subject to previous road construction, stormwater drainage systems, undergrounded electric lines and on-going maintenance. Project area soils consisted of clays, silts, gravels, rounded and subangular pebbles, and showed signs of disturbance and fill. No archaeological sites, features, or artifacts were discovered within the APE during the surface survey.

CEQA does not require consultation with Native American tribes although many tribes expect consultation. Consultations with local Native American Tribes were conducted, at the cultural resources management level, in order to solicit assistance in identifying archaeological resources that may exist or be affected by the project. A letter was sent to the NAHC requesting a search of the Sacred Lands Inventory File and a current list of local Native American groups and individuals who may have interests and/or concerns with the project. Letter requests were sent on September 3, 2013, as well as emails and telephone calls, were made to local Native American representatives, including the Blue Lake Rancheria, Big Lagoon Rancheria, Yurok Tribe, Trinidad Rancheria, Tsurai Ancestral Society, the Trinidad Museum Society, and at the request of the Tsurai Ancestral Society an additional letter was sent to the Tsurai Ancestral Society at P.O Box 62, Trinidad, CA 95570.

The southern-most portion of the APE of the project is approximately 100 meters north of a previously recorded Yurok habitation site; however, no previously recorded sites were located within the APE. Because of the sensitivity of the entire Trinidad area there is a risk of encountering Native American and/or Euroamerican historic resources. The project is also near the old Gold Rush town center and the APE runs through one of the oldest cities in California raising the possibility of encountering Euroamerican historic resources. In addition the Trinidad Rancheria and the Tsurai Ancestral Society, during consultations, have requested Native American monitoring. The City of Trinidad requires Native American monitoring as a condition of issuing excavation encroachment permits. The following mitigation measures are included to reduce any potentially significant impacts to historic or archaeological resources.

- **Mitigation Measure CR-1: Cultural Monitor**

1. Qualified cultural monitors will be hired by the contractor prior to construction.

2. Cultural monitors must be onsite during grading and earthwork activities. Cultural monitors are to include both a tribally trained monitor and a Bachelor of Arts or higher level archaeologist, with field-school training in historical archaeology or two years of experience in historical archaeology.

3. Cultural Resource Monitors must be empowered to halt heavy equipment operations in the event that significant cultural features or human remains are uncovered. Construction activities in the immediate vicinity would be delayed until an archaeologist, qualified to the Secretary of Interior Standards, has assessed the significance of the find.

4. The Cultural Resource Monitor must be kept informed by the contractor and understand the ground disturbance schedule. Field notes should be kept by the Cultural Resource Monitor and a brief letter report of the monitoring effort filed with the North Coastal Information Center. The Cultural Resource Monitor need only be present during ground disturbing activities.

There is a possibility that historic resources, including buried archaeological materials, do exist in the area and may be uncovered during project activities. The following mitigation measure is included to ensure that potential project impacts on inadvertently discovered historic resources are eliminated or reduced to less than significant levels.

- **Mitigation Measure CR-2: Identify and Avoid or Minimize Impacts to Unknown Historic and/or Archaeological Resources**

If cultural resources, such as chipped or ground stone, historic debris, building foundations, or bone are discovered during ground-disturbance activities, work shall be stopped within 20 meters (66 feet) of the discovery, per the requirements of CEQA (January 1999 Revised Guidelines, Title 14 CCR 15064.5 (f)) and Section 106 (36 CFR 800). Work near the archaeological finds shall not resume until a professional archaeologist, who meets the Secretary of the Interior's Standards and Guidelines, has evaluated the materials and offered recommendations for further action.

Prehistoric materials which could be encountered include: obsidian and chert flakes or lithic materials, grinding implements, (e.g., pestles, handstones, mortars, slabs), bedrock outcrops and boulders with mortar cups, locally darkened midden, deposits of shell, dietary bone, and human burials. Historic materials which could be encountered include: ceramics/pottery, glass, metal, can and bottle dumps, cut bone, barbed wire fences, building pads, structures, trails/roads, railroad rails and ties, and trestles.

Implementation of Mitigation Measures CR-1 and CR-2 would reduce potentially significant impacts to less than significant levels by protecting, preserving, or recovering any significant cultural resources, including historical resources, affected by project construction.

c) Paleontological or Geological Resources – Less than Significant with Mitigation

Paleontological resources are the remains or traces of prehistoric animals and plants. Paleontological resources, which include fossil remains and geologic sites with fossil-bearing strata are non-renewable and scarce and are a sensitive resource afforded protection under environmental legislation in California. Under California Public Resources Code (CPR) Section 5097.5, unauthorized disturbance or removal of a fossil locality or remains on public land is a misdemeanour. State law also requires reasonable mitigation of adverse environmental impacts that result from development of public land and affect paleontological resources (CPR Section 30244).

According to the *Geologic and Seismic Characteristics of Trinidad, CA*, (Streamline Planning Consultants 2007), which was prepared for the Trinidad General Plan Update, the Trinidad area is underlain by a geologic unit commonly referred to as the Franciscan Formation. Franciscan rocks have their origins in the deep sea, where they were formed by turbidity currents that deposited sand, mud, gravel, and silica from the shells of marine creatures. These substances accumulated over tens of millions of years and hardened to form sandstone, shale, conglomerate, greenstone, and chert. The Franciscan Formation consists of blocks of resistant sedimentary and metamorphic rock within a matrix of sheared, deformed, and highly erodible rock. Due to the common seismic activity and rapid uplift of this formation, the young Franciscan geology does not generally contain paleontological resources.

It is unlikely that project construction would impact paleontological resources; therefore, the impact is considered less than significant.

d) Human Remains – Less than Significant Impact

Although no known cemeteries or burial sites are located on the project sites, given the long history of human activity in the area, encountering human remains during construction activities is possible. If human remains are discovered during construction of the project, impacts could be significant. As such, Environmental Protection Action 2, *Procedures for Encountering Human Remains*, has been incorporated into this project to reduce any potential impacts to less than significant by providing standard procedures in the event that human remains are encountered during project construction and adherence to Public Resources Code Sections 7050.5, 5097 and 5097.98 requiring Native American tribal notification.

3.6 Geology and Soils

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.				✓
ii) Strong seismic ground shaking?			✓	
iii) Seismic related ground failure, including liquefaction?				✓
iv) Landslides?			✓	
b) Result in substantial soil erosion or the loss of topsoil?			✓	
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on, or off, site landslide, lateral spreading, subsidence, liquefaction or collapse?				✓
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?			✓	
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?			✓	

3.6.1 Discussion

According to the Geotechnical Report (Appendix G), the Franciscan Complex, a late Mesozoic complex of subducted rocks composed of highly sheared oceanic sediments that were deformed above the oceanic plate (which is sliding underneath western North America) comprises the bedrock underlying the project area (Aalto 1982). These Franciscan rocks comprise the competent rocks of resistant headlands and sea stacks along the Trinidad coast and consist of greywacke, sandstone, marine sandstones, biogenic ribbon chert, limestone, greenstone, ultramafic and mafic plutonic rocks, and bluechist-facies metamorphic rocks (Aalto 1976). The lesser constituents exist as blocks, or mixtures of blocks, ranging on a scale from centimeters to kilometers in length along northern California within mélange units. The mixtures of blocks comprising mélanges exist in a highly sheared shale and/or serpentinite matrix often described as 'plum pudding' or 'blue goo' (Aalto 2009).

The Franciscan Formation is unconformably overlain by Pleistocene marine terraces along the Trinidad coast, within the project area, and up to several miles inland. The presence of stair-stepping, progressively older (and higher in elevation) marine terraces inland is a result of the ongoing deformation of the northern California coast along thrust faults, which account for most of the uplift.

According to the City of Trinidad General Plan, soils information indicates that the developable areas south of Mill Creek generally have only slight soils limitations, whereas most of the areas north of Mill Creek are subject to soils limitations. Unless restrictions on development intensity are imposed for other reasons, areas with slight limitations can be developed to higher densities.

a.i) Fault Rupture – No Impact

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This act prohibits the location of structures designed for human occupancy across active faults and regulates construction within fault zones. Within Trinidad, the Trinidad Fault (part of the Mad River Fault Zone) has been designated under the Alquist-Priolo Act of 1972. The zone encompasses about 60 acres, or 19% of the land within the City limits. In this zone, any new development of structures for human occupancy would be required to undergo a geologic study before a building permit would be issued (California Division of Mines and Geology 1995). However, the project does not include housing or structures for human occupancy subject to the Alquist-Priolo Act. In addition, none of the project sites fall within the zone. Therefore, no impact would occur.

a.ii) Ground Shaking – Less than Significant Impact

All of coastal Northern California is subject to potentially strong seismic ground shaking and multiple earthquake sources capable of generating moderate to strong earthquakes are in close proximity to the project site. Strong seismic shaking is a regional hazard that could cause major damage to the project area. The extent of ground-shaking during an earthquake is controlled by the earthquake magnitude and intensity, distance to the epicenter, and the geologic conditions in the area.

The proposed project would not expose people or structures to seismic ground shaking and the project does not involve the construction of structures which would be occupied by people. Structures will be built to current standards. The impact is less than significant.

a.iii) Liquefaction – No Impact

Liquefaction is the transformation of saturated, loose, fine-grained sediment to a fluid-like state because of earthquake shaking or other rapid loading. Liquefaction is known to occur in loose or moderately saturated granular soils with poor drainage.

The proposed project would not include residential development, occupied structures, or critical facilities that would be subject to liquefaction. Liquefaction caused by seismic shaking has a low probability of occurrence in Trinidad. A liquefaction potential map produced by California Division of Mines and Geology (CDMG) shows no potential for this occurring in the Trinidad area (Streamline Planning Consultants 2007). Therefore, no impact would occur.

a.iv) Landslides – Less than Significant Impact

Steep slopes and unstable geologic material create erosion and landslide hazards in some of the Trinidad area. Coastal bluffs are especially subject to these hazards because of continuous wave erosion. Several types of slope failure have the potential to occur in the Trinidad area. Earthflows and debris flows are the most common, and tend to happen on the clay-rich material of the Franciscan matrix. This type of landslide poses a danger to structures because it often involves the movement of large blocks of material, such as the ones that come to rest on Trinidad State Beach. Active flows are generally characterized by a “head” scarp at the upslope end and either a lumpy “toe” of debris or a cohesive block of material at the downslope end, so they can be recognized in the field. Currently there are no active landslides that may constrain development near the project sites (Streamline Planning Consultants 2007). Additionally, as noted in Section 3.17.1 a, e), Groundwater modelling results were reviewed by Engineers at Crawford & Associates, Inc. and HydroGeoLogic Inc. to verify that the locations and quantities of stormwater infiltration will not compromise bluff stability. The project would not expose people or structures to substantial risk of landslides for the reasons stated above. The impact is less than significant.

b) Loss of Topsoil – Less than Significant Impact

Construction activities, including cut, fill, removal of vegetation, and operation of heavy equipment would disturb soil and, therefore, have the potential to cause erosion. An erosion control plan (Environmental Protection Action 3) would be prepared for the project prior to the start of construction and soil disturbance. The erosion control plan would include BMPs designed to reduce erosion of exposed soil and minimize the sediment entrained in runoff from the site during construction. BMPs may include: silt fences, straw bales and wattles, soil stabilization controls, site watering for controlling dust, and sediment detention basins.

Implementation of LID stormwater improvements will reduce runoff by capturing rainwater or allowing it to infiltrate the soil. All disturbed areas within sensitive habitat areas would be re-vegetated following construction with native species that would serve to stabilize site conditions and prevent invasive species from colonizing. Ground disturbance would be mulched with straw or other appropriate material. With the implementation of Mitigation Measure HYD-1, potential impacts to soil erosion or the loss of topsoil would be less than significant.

c) Unstable Soil – Less than Significant Impact

A Geotechnical Analysis report was prepared for this project and is included as Appendix G. The geotechnical investigation, with regard to soils in the project area, concluded that there are three marine terraces mapped as follows within the project area: (Rust 1982, Stephens 1982); Trinidad Low marine terrace (Qtmtl, approximately 40,000 years old), located closest to Trinidad Head, the Luffenholtz marine terrace (Qtml, approximately 60,000 years old) and the Patrick’s Point terrace (Qtmpp, approximately 83,000 years old).

According to the map produced by Rust (1982), the City was built on the Patrick's Point Terrace (Qtmpp). Additionally, the Trinidad Low marine terrace and/or the Luffenholtz marine terrace (Qtml) unconformably overlies an older (approximately 370 years old) marine terrace, marked with a paleosol (buried soil) at the contact (Stephens 1982, Rust 1982). These marine terraces can be generally described as thin to massive intervals of fine to coarse beach sands (mixed with various quantities of silt) containing local stringers of beach and fluvial gravels.

As noted previously, steep slopes and unstable geologic material create erosion and landslide hazards in some of the Trinidad area. According to the *Geologic and Seismic Characteristics of Trinidad, CA*, report (Streamline Planning Consultants 2007), parcels located on highly unstable slopes within Trinidad have been mapped using Geographic Information Systems (GIS). Parcels located on highly unstable slopes within the project area include parcels to the west of Lighthouse Road and south of Van Wycke Street. However, these areas are not part of the project. The impact is less than significant.

d) Expansive Soils – Less than Significant Impact

Expansive soils are generally high in certain clay types and are prone to large volume changes that are directly related to changes in water content. The USDA Natural Resources Conservation Service is in the process of mapping Humboldt County soil types. As noted above, the marine terraces that comprise the project area can be generally described as thin to massive intervals of fine to coarse beach sands (mixed with various quantities of silt) containing local stringers of beach and fluvial gravels.

According to the geotechnical report prepared for the project (Appendix G), the marine terrace formation underlying the majority of the project area is dominated by fine to medium-grained beach sand, up to 70 feet thick, with local discontinuous thin layers of silt and gravel generally less than two feet thick. These substrate types are unlikely to be classified as expansive because they are generally well drained and do not include a substantial clay component. The impact from expansive soils would be less than significant.

e) Septic Tanks – Less than Significant Impact

An important component to understanding the subsurface system in Trinidad is the influence of septic systems on groundwater flow. All properties within the City discharge wastewater to individual septic systems or other onsite wastewater treatment systems. Groundwater flow into the subsurface system below the City is limited by the capacity of the upper soil layer to infiltrate water (the aquifer) and carry it in the groundwater and the two creeks (to the north and south) which direct groundwater away from the City. Thus, it is believed that flow from septic discharge constitutes a significant portion of the groundwater flow, especially during the summer months.

The geotechnical investigation (Appendix G) was completed to determine existing groundwater flow patterns and physical properties of the aquifer to understand subsurface conditions so that stormwater can be effectively infiltrated without negatively affecting the function of the numerous existing on-site wastewater treatment systems (OWTS/septic systems).

A review of the City's groundwater model was conducted by HydrolGeologic, Inc. and is summarized in the memo attached as Appendix D. The model was found to be consistent with data in the Geotechnical Analysis Report (Appendix G). The model was verified against observed potentiometric elevations and was found to be consistent with field observations.

The Slope Stability Analyses (Appendix C), prepared by Crawford and Associates, was completed along selected bluff sections using SLIDE software by RocScience. Comparisons were made between groundwater elevations under existing conditions and under maximum (peak) infiltration based on a 50-year storm. Each section was analysed to determine the critical failure surface, recognizing that the south bluffs along Trinidad Bay have experienced past failures within the terrace soils. The analyses showed a relatively small (about 15% or less) reduction in factor of safety at the 50-year storm event; however, the 50-year event will result in a peak groundwater level for only a few hours in duration. The reduced factor of safety was considered acceptable for short (transient) periods of time. At the Mill Creek tributary, the review indicated this drainage to be relatively steep and heavily vegetated, with the slope comprised of terrace soils similar to the bluffs. Crawford and Associates did not observe evidence of significant instability along these slopes, and they do not anticipate short-term increases in hydraulic head to have an adverse impact to these slopes (Appendix C).

During project design, GHD reviewed health department files, and known locations of septic systems were taken into account. Because the project does not include septic tanks or alternative wastewater disposal systems, and because the stormwater improvements will not impact or be located on soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems, a less than significant impact would occur.

3.7 Greenhouse Gas Emissions

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?			✓	
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?				✓

3.7.1 Discussion

Climate change refers to change in the Earth's weather patterns including the rise in the Earth's temperature due to an increase in heat-trapping or "greenhouse" gases (GHGs) in the atmosphere. Unlike emissions of criteria and toxic air pollutants, which have local or regional impacts, emissions of GHGs that contribute to global warming or global climate change have a broader, global impact. Global warming is a process whereby GHGs accumulating in the atmosphere contribute to an increase in the temperature of the Earth's atmosphere. The principal GHGs contributing to global warming are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and fluorinated compounds. These gases allow visible and ultraviolet light from the sun to pass through the atmosphere, but they prevent heat from escaping back out into space. Among the potential implications of global warming are rising sea levels, and adverse impacts to water supply, water quality, agriculture, forestry, and habitats. Like most criteria and toxic air contaminants, much of the GHG production comes from motor vehicles. GHG emissions can be reduced to some degree by improved coordination of land use and transportation planning at the City, county and subregional level, and other measures to reduce automobile use. Energy conservation measures also can contribute to reductions in GHG emissions (BAAQMD 2012).

The California Global Warming Solutions Act of 2006 (Assembly Bill 32) definitively established the state's climate change policy and sets GHG reduction targets (Health & Safety Code §38500 et seq.). The state set its target at reducing greenhouse gases to 1990 levels by 2020.

The NCUAQMD does not have rules, regulations, or thresholds of significance for non-stationary or construction-related GHG emissions. In 2011, the NCUAQMD adopted Rule 111 - Federal Permitting Requirements for Sources of Greenhouse Gases to establish a threshold above which New Source Review (NSR) and federal Title V permitting applies and to establish federally enforceable limits on potential to emit greenhouse gases for stationary sources. These are considered requirements for stationary sources and should not be used as a threshold of significance for non-stationary source projects.

The existing Trinidad General Plan predates modern planning relevant to GHG emissions and global warming. The City is in the process of updating its General Plan and has prepared a Draft Climate Action Plan (CAP) (April 2010) which is available on the City's website. The Draft CAP is meant to serve as a template or framework to assist Trinidad in adopting its own CAP and implementation measures. The overarching goal of the Draft CAP is to provide support for greenhouse gas reduction measures by providing supporting policies and assembly bills which focus on the reduction of gasses, either indirectly such as through waste diversion or livability, or directly through energy efficiency and reduced vehicle miles traveled. The Draft CAP provides tools and recommendations to increase community involvement, awareness, and implementation of emission reduction measures.

In 2007 the Humboldt County Board of Supervisors initiated a campaign in an effort to reduce county-wide carbon emissions by committing to implement the following milestone steps:

- Conduct a baseline emissions inventory and forecast of emissions growth.
- Set an emissions reduction target.
- Develop a Climate Action Plan to meet the emissions reduction target.
- Implement the Climate Action Plan.
- Monitor and report progress and results.

a) Generation of Greenhouse Gas Emissions – Less than Significant Impact

Construction

Construction of the project would cause GHG emissions as a result of combustion of fossil fuels used in construction equipment. The project would require the use of several pieces of heavy earthmoving equipment, delivery trucks, construction commute and utility vehicles, paving equipment, in addition to generators, and other small engine-powered tools. The NCUAQMD has not adopted a threshold for construction-related GHG emissions against which to evaluate significance and has not established construction-generated criteria air pollutant screening levels above which quantitative air quality emissions would be required. Guidelines established by the Sacramento Metropolitan Air Quality Management District (SMAQMD) suggest that the SMAQMD would expect qualitative analysis be conducted for projects substantially greater in scope than the proposed project. For example, quantitative analysis would be expected for a school or commercial facility construction project over 30 acres, a city park over 60 acres, or a single family residential development with over 180 units (SMAQMD 2009). Project emissions during construction of the project would not approach the level of emissions associated with these reference project types and would not cause a considerable contribution to the cumulative GHG impact. Given the project's relatively limited scale, scope, and duration, it would not have a noticeable or considerable contribution to the cumulative GHG impact. The impact would be less than significant.

Operations

The project would include only minor and negligible operational GHG emissions associated with the repair and maintenance of stormwater facilities as needed. The level of repair and maintenance would not lead to an increase in GHG emissions or a related impact. The impact would be less than significant.

b) Conflict with an Applicable Plan, Policy, or Regulation – No Impact

As stated above, the City of Trinidad has prepared a Draft CAP as part of the General Plan update process, but has not yet adopted it or any formal GHG emission reduction policies in its General Plan. The County has adopted a resolution in commitment to reduce GHG emissions, as described above. Although the project would produce a minor amount of construction-related emissions, the project would not conflict with these plans and policies and there would be no impact.

3.8 Hazards and Hazardous Materials

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?			✓	
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?			✓	
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?			✓	
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?				✓
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?				✓
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?				✓
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				✓
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?			✓	

3.8.1 Discussion

There are several sources of hazardous materials that can affect Trinidad. Fuel oil spills are a constant threat from towing, parking and operation of fleet vehicles, visitor/ resident/patron parking and delivery vehicles. Business and household hazardous waste has a tendency to accumulate in and around residential areas in the form of cleaners, solvents, lubricants, paints, and adhesives. Machinery/appliance leaks from businesses or construction sites can potentially be uncontained. If these materials are not properly disposed of or recycled they present a serious threat to the health and wellbeing of the residents and the environment (City of Trinidad 2012).

The City has an adopted *City Emergency Plan*. The purpose of this plan is to ensure that the City will be prepared to respond effectively in the event of emergencies to save lives, restore and protect property, repair and restore essential public services, and provide for the storage and distribution of medical, food, water, shelter sites, and other vital supplies to maintain the continuity of government (City of Trinidad 2012).

a) Transport, Use, and Disposal of Hazardous Materials – Less than Significant Impact

Project construction would require the use of hazardous materials such as fuels, lubricants, paints, and solvents. Following construction, the project would not result in the storage or transport of hazardous materials. Numerous laws and regulations ensure the safe transportation, use, storage and disposal of hazardous materials. Worker safety regulations cover hazards related to exposure to hazardous materials. Regulations and criteria for the disposal of hazardous materials mandate disposal at appropriate landfills. Because the City, contractors, and other construction service providers would be required to comply with existing hazardous materials laws and regulations for the transport, use, and disposal of hazardous materials, the impacts associated with the potential to create a significant hazard to the public or the environment would be less than significant.

b) Upset or Accidents Involving Hazardous Materials – Less than Significant Impact

During construction, routine transport of hazardous materials to and from the project area could indirectly result in an incremental increase in the potential for accidents. Caltrans, the Federal Department of Transportation, and the California Highway Patrol (CHP) regulate the transportation of hazardous materials and wastes, including container types and packaging requirements, as well as licensing and training for truck operators, chemical handlers, and hazardous waste haulers. Because the City, contractors, and other construction service providers would be required to comply with existing hazardous materials laws and regulations for the transport of hazardous materials, the impacts associated with the potential to create a significant hazard to the public or the environment would be less than significant. Under Mitigation HYD-1, an additional level of safety would occur with the requirement to implement BMPs with regard to hazardous materials and sediment.

c) Emit Hazardous Materials within 0.25 Mile of a School – Less than Significant Impact

Trinidad Elementary School is located in the project area on Trinity Street. An infiltration gallery and storm drain is proposed for Trinity Street directly in front of the school. No aspect of the LID/BMP stormwater improvements are expected to emit hazardous materials, and as noted above, the City, contractors, and other construction service providers would be required to comply with existing hazardous materials laws and regulations for the safe transport, use, and disposal of hazardous materials. Therefore, the impact is less than significant.

d) Included on a List of Hazardous Materials Sites – No Impact

There are no hazardous materials sites compiled pursuant to Government Code Section 65962.5 (Hazardous Waste and Substances Site List or "Cortese" list) within the project area. The nearest site on this list is the McNamara and Peepe Lumber Mill in Arcata. GHD further researched listed sites that have the potential to affect the project area by reviewing available records on the SWRCB GeoTracker Website. The closest active site on this list is a LUST cleanup site at Patricks Point State Park which is approximately three miles north of the project area. The project is not located on a Cortese list or other list of hazardous materials sites and would therefore not create a hazard to the public or environment. No impact would occur.

e, f) Safety Hazard for People Residing or Working Within 2 Miles of an Airport – No Impact

There are no public or private airports within two miles of the project. The nearest public airport, Arcata-Eureka Airport, is located approximately eight miles south of the project area (Airnav 2013). The project would not result in airport-related safety hazards for people residing or working in the project area. No impact would occur.

g) Impair or Interfere with an Adopted Emergency Response/Evacuation Plan – No Impact

The Humboldt County Sheriff's Office of Emergency Services (OES) coordinates countywide response to disasters. OES is responsible for alerting and notifying appropriate agencies when disaster strikes; coordinating all agencies that respond; ensuring resources are available and mobilized in times of disaster; developing plans and procedures for response to and recovery from disasters; and developing and providing preparedness materials for the public. The OES would coordinate evacuation planning in the event of seismic events, tsunamis, slope failure, floods, storms, fires, and hazardous materials spills. The OES is responsible for maintaining the *Humboldt County Emergency Operations Plan*, which serves to address the planned response to extraordinary emergency situations associated with natural disasters, technological incidents, and national security emergencies in or affecting Humboldt County. OES also maintains specific hazard response plans for earthquake, flooding, tsunamis, coastal storms, and other events. These response plans are used to determine the most appropriate evacuation routes based on the nature and extent of hazard.

As noted previously, the City has an adopted *City Emergency Plan*. The City's plan is consistent with OES's plan and the project won't interfere with either plan. The project will not impair or interfere with any emergency response/evacuation plans and does not include development that would significantly increase the number of people exposed to potential emergencies. Furthermore, no roads would be closed as a result of project activities. No impact would occur.

h) Exposure to Wildland Fires – Less than Significant Impact

Government Code Sections 51175-89 directs the California Department of Forestry and Fire Protection (CAL FIRE) to map areas of very high fire hazard within Local Responsibility Areas (LRA). Mapping of the areas, referred to as Very High Fire Hazard Severity Zones (VHFHSZ), is based on relevant factors such as fuels, terrain, and weather.

Most of the project area and the entire project site is located in a “High” fire hazard severity zone within the LRA, as classified by Cal Fire (CAL FIRE 2008). The County’s GIS designates the area north of Trinidad as an area of Moderate Fire Hazard Severity and the area east of Trinidad as High Fire Hazard Severity.

For the 9.9 square miles of the Trinidad Planning Area, there are two volunteer fire departments—one in Trinidad proper and the other in Westhaven. CalFire is also stationed on Patricks Point Drive and they respond to emergencies like wildland and structure fires, floods, earthquakes, hazardous material spills, and medical aids. Mutual aid agreements exist between all of the stations, continuing the agreement from the 1980’s generated from a fire in Trinidad State Park that threatened residences along Underwood Drive (City of Trinidad 2012).

Temporary water storage tanks may be used during construction, but no dedicated fire suppression water tanks are proposed. Construction involving heavy equipment, vehicles, power tools, and personnel smoking in and around the project site could cause the ignition of a wildfire; however, the project site is within the urbanized area of Trinidad and are not any different than normal urban activities, so the possibility of a wildfire is remote. The impact is less than significant.

3.9 Hydrology and Water Quality

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

3.9.1 Discussion

Construction activities can introduce pollutants to stormwater runoff, including sediment, paints, solvents, pavement, construction debris and trash, as well as hydrocarbons and other fluids from construction vehicles. Though these impacts would be reduced by the limited scale of ground disturbance, the most likely pollutant from the proposed project would be sediment created by soil disturbance during or immediately after construction. These potential pollutants are regulated under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with

Construction and Land Disturbance Activities (Order Number 2009-0009-DWQ, NPDES Number CAS000002; a.k.a construction general permit). This construction general permit offers NPDES coverage for stormwater discharges with construction activities of more than 1.0 acre, and would apply if the project disturbs over one acre of ground. It is anticipated that actual ground disturbance will be less than one acre (0.8 acres); therefore, the project would not trigger the requirement for a SWPPP.

a, f) Violate Water Quality Standards or Degrade Water Quality – Less than Significant with Mitigation

The Trinidad State Beach is listed on the Clean Water Act Section 303(d) list for bacterial contamination. According to the data, the watershed area affected is one square mile in size, is currently being addressed, and is expected to be completed by 2019 (SWRCB 2010). Trinidad State Beach is adjacent to the project area to the west between the cliff bluffs and Pacific Ocean. In addition, as previously described, Trinidad Bay is a State designated ASBS with a discharge prohibition. Project activities will not take place along the shoreline; however, Trinidad State Beach and ocean waters could be potentially affected by runoff from project activities. With incorporation of Environmental Protection Action 3, *Erosion Control Plan*, the project would not violate water quality standards or waste discharge requirements, or otherwise substantially degrade water quality. Additionally, project activities such as the bio-swales and rain gardens will be effective at removing sediment by trapping suspended particles as stormwater flows through the vegetation, which acts like a filter. Bio-swales also help remove other contaminants and can store and infiltrate stormwater similar to rain gardens.

Dewatering of the construction work area could be required if groundwater accumulates in excavation areas. The discharge of construction dewatering could result in a source of sediment-laden water to local waterways if not properly controlled. With incorporation of Environmental Protection Action 4, *Construction Dewatering Reduction* into the project, the potential impact from construction dewatering activities would be held to a less than significant level by sequencing construction to coincide with the period of the lowest groundwater levels at the site to eliminate the need for dewatering. If dewatering is needed, Environmental Protection Action 4 also includes proper management actions to reduce water pollution.

Construction of the project would also require the use of gasoline and diesel-powered equipment, such as trucks, excavators, graders, bulldozers, backhoes, compactors, and generators. Chemicals such as diesel, gasoline, lubricants, hydraulic fluid, transmission fluid, paints, solvents, glues, and other substances would be utilized during construction. An accidental release of any of these substances could degrade surface or ground water and cause a significant impact, particularly if this were to occur in an area that drains towards the ASBS. Therefore, the following mitigation is included:

- **Mitigation Measure HYD -1 BMPs to be Implemented During Construction**
  - At all times during construction activities, the contractor shall minimize the area disturbed by excavation, grading, or earth moving to prevent the release of excessive fugitive dust. During periods of high winds (i.e. wind

speed sufficient that fugitive dust leaves the site) contractor shall cover or treat areas of exposed soil and active portions of the construction site to prevent fugitive dust.

- No construction materials, equipment, debris, or waste shall be placed or stored where it may be subject to wind, or rain erosion and dispersion. Material handling on and offsite shall be required to comply with California Vehicle Code Sec. 23114 with regard to covering loads to prevent materials spills onto public roads.
- All construction equipment shall be equipped and maintained to meet applicable EPA and CARB emission requirements for the duration of construction activities.
- Throughout construction, contractor shall maintain adjacent paved areas free of visible soil, sand or other debris.
- If stockpiled on or offsite, or if rain is expected, soil and aggregate materials shall be covered with secured plastic sheeting and runoff shall be diverted around them.
- Drainage courses, creeks, or catch basins shall be protected with straw bales, silt fences, and/or straw wattles.
- Storm drain inlets shall be protected from sediment-laden runoff with sand bag barriers, filter fabric fences, straw wattles, block and gravel filters, and excavated drop inlet sediment traps.
- Vehicle and equipment parking and vehicle maintenance shall be conducted in designated areas away from creeks or storm drain inlets.
- Major maintenance, repair, and washing of vehicles and other equipment shall be conducted offsite or in a designated and controlled area.
- Construction debris, plant and organic material, trash, and hazardous materials shall be collected and properly disposed.

See also Environmental Protection Action 3 – *Erosion Control Plan*.

With implementation of Environmental Protection Actions 3 and 4, and Mitigation Measure HYD-1, the impacts to water quality would be less than significant after mitigation. No further action is warranted.

b) Substantially Deplete Groundwater Supplies or Interfere with Groundwater Recharge – Less than Significant Impact

As discussed above, dewatering of the construction work area could be required if groundwater accumulates in an excavation area. Dewatering typically involves pumping water out of the excavation area to lower groundwater levels to the extent needed for construction. Any water table draw-down during project construction would be very minor and localized and would not affect the ability of any off-site wells to draw water; there are no private wells within the City limits.

The proposed project will have a positive impact on the city's groundwater supplies and recharge by modernizing the City stormwater system through incorporation of LID/BMPs to capture, treat, and infiltrate stormwater runoff.

As noted previously, a review of the City's groundwater model was conducted by HydrolGeologic, Inc. and is summarized in the memo attached as Appendix D. The model was found to be consistent with the conceptual model outlined in the Geotechnical Analysis Report (Appendix G). The model was verified against observed potentiometric elevations and was found to be consistent with field observations.

Following construction of the project, there will be a positive direct operational effect on the City's groundwater table and groundwater recharge by increasing infiltration without any detrimental impacts to streams, septic systems and bluff stability. Precipitation within the project area would continue to infiltrate into the ground with additional infiltration through bio-swales, infiltration basins and rain gardens. The project would not interfere with groundwater recharge and there would be no impact to groundwater supplies or groundwater recharge from construction and operation. A less than significant impact has been identified.

c) Alter Drainage Patterns – Less than Significant Impact

Currently, stormwater that accumulates in the northern portion of Trinidad drains into Mill Creek, which discharges near Trinidad State Beach approximately 500 feet north of the ASBS. Approximately 20 percent of the City's stormwater currently drains to Mill Creek. The remaining 80 percent of the City's stormwater discharges into the TR1032 outfall (Figure1).

One of the long-term goals of the City is to eliminate polluted stormwater discharge from the City to the ASBS for storms up to the 50-year event. Stormwater runoff will be reduced through the implementation of LID/BMPs installed throughout the City. The use of LID techniques to retain, treat, and infiltrate stormwater is an effective means to meet stormwater goals.

Construction activities such as excavation, grading, and trenching would temporarily disturb the ground surface of the project area and could result in erosion if not properly controlled and repaired. With incorporation of Environmental Protection Action 3, *Erosion Control Plan*, into the project, the potential impact from construction activities would be held to a less than significant level by including erosion control actions to reduce soil loss and water pollution.

Following construction, the drainage patterns in the project area would be improved upon over their current conditions in that stormwater runoff will be reduced and infiltration increased through the implementation of LID/BMPs. Therefore, the proposed project will have a beneficial effect on drainage patterns in the City. No stream or river courses would be altered. The impact would be less than significant.

d, e) Increase Runoff Resulting in Flooding or Exceed Capacity of Storm Drain System – Less than Significant Impact

As noted in the previous sections under Hydrology and Water Quality, the proposed project will have a beneficial effect on the ASBS by reducing pollutant levels. The proposed project will substantially alter the drainage pattern of the area; however, the LID/BMPs stormwater improvements have been designed to reduce the potential for flooding in the project area and reduce the potential for polluted runoff entering the ASBS by mimicking a more natural drainage and infiltration pattern. Reference Appendix C (Slope Stability Analyses), Appendix D (Trinidad Model Review), and Appendix G (Geotechnical Analysis Report) for more detailed technical information. A less than significant impact has been identified.

g, h) Place Housing and/or Structures Within a 100-Year Flood Zone – No Impact

The only flood hazard zone mapping is by the County and is located on Mill Creek on the eastern edge of the City boundary. According to the *Trinidad Draft General Plan Draft Noise & Safety Element*, the City of Trinidad did not participate in Federal Emergency Management Agency (FEMA) flood mapping for the City because its steep slopes render the risk of flooding generally non-existent. The proposed project will not cause the construction of housing or structures within a 100-year flood zone, therefore, no impact would occur.

i) Flooding From a Levee or Dam Failure – No Impact

According to the Humboldt Operational Area – Hazard Mitigation Plan (HMP), the project area is not located within a dam failure inundation area. The HMP includes information on risk assessment and mitigation strategies for hazards from dam failure and other hazards such as flooding, tsunamis, earthquakes, etc. The proposed project does not include activities or components which will expose people or structures to a significant risk of loss from flooding or levee or dam failure. No impact would occur.

j) Inundation by Seiche, Tsunami, or Mudflow – Less than Significant Impact

Based on area characteristics, the project site is not down-gradient of a debris-flow source and would not be subject to mudflows. The project site is also not near any enclosed water body capable of producing a seiche event. According to the State of California Humboldt County Tsunami Inundation Map for Emergency Planning, the tsunami inundation zone in Trinidad generally ends at the cliff bluffs face and Van Wycke Street to the south (CEMA 2009), which is outside the project area. A less than significant impact would occur.

3.10 Land Use and Planning

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Physically divide an established community?				✓
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?			✓	
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?				✓

3.10.1 Discussion

The project area includes City of Trinidad zoning and land use designations including: Open Space, Special Environment, Suburban Residential, Urban Residential, Planned Development, Commercial, Visitor Services and Public & Religious. The LID/BMPs stormwater improvements will generally be within existing public road ROW as shown in Figure 2. ROW do not have zoning or land use designations associated with them. Project activities will not conflict with existing land use and zoning.

The currently adopted General Plan does not address LID stormwater techniques; however, the Draft General Plan Update includes LID policies. Program CONS-3.2 calls for the City to incorporate fundamentals of LID technologies into its implementation plans and provide education/incentives to property owners to incorporate LID alternatives. Program CONS-1.2 calls for the City to use public education programs to promote environmentally responsible building designs and construction practices, including LID technologies and techniques.

a) Physically Divide an Established Community – No Impact

The project would include modernizing the City stormwater system through incorporation of LID/BMPs to capture, treat, and infiltrate stormwater runoff. No aspect of the project would physically divide the community; therefore, no impact would occur.

b) Conflict with Applicable Land Use Plans, Policies or Regulations – Less than Significant Impact

The project area is entirely within the California Coastal Zone, and the City has a Local Coastal Program that has been certified by the Coastal Commission. Therefore, the project is within the City's Coastal Development Permit jurisdiction, and some of the project elements are sited within the Coastal Commission's appeal jurisdiction. In order to construct the project, the City must process and approve a coastal development permit

(CDP) and in doing so would be in compliance with the Local Coastal Program and California Coastal Act.

The project would not require a General Plan Land Use designation or zoning change and would not conflict with any applicable plan, policy or regulation with jurisdiction over the project area. Therefore, the impact would be less than significant.

c) Conflict with any Applicable Habitat Conservation Plan – No Impact

The City of Trinidad does not have an adopted Habitat Conservation Plan, or Natural Community Conservation Plan which applies to the project area; therefore, no impact would occur.

3.11 Mineral Resources

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?			✓	
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?			✓	

3.11.1 Discussion

According to the Draft General Plan Update Draft Conservation Open Space and Recreation Element, there are no mining operations within the City limits. The only nearby activities include hard rock quarries: one exists off Quarry Road (Mercer-Fraser Company); several others are located on Simpson Green Diamond Timber land to the east. These quarries provide a source of jetty-quality rock.

a, b) Result in the Loss of Availability of a Known Mineral Resource of Value to the Region or Delineated by a General Plan, Specific Plan or other Land Use Plan – Less than Significant Impact

The project would not require the use of a substantial amount of any mineral resource, and would not result in the loss of availability of known mineral resources of value to the state, region or locally; therefore, the impact would be less than significant.

3.12 Noise

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?			✓	
b) Exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels?			✓	
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?			✓	
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?			✓	
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				✓
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?				✓

3.12.1 Discussion

The project site and surrounding area are primarily characterized by low density residential uses, educational uses, commercial uses, open space and recreational uses, Highway 101 to the east, and the Pacific Ocean to the west and south. Noise levels in the project area vary depending on the proximity to human activity, Highway 101, and commercial activities in Trinidad. Depending on the weather and proximity to the coast, wind and waves can be significant noise generators as well. Highway 101 runs north-south to the east of the project area. Ambient noise levels in the project area are reduced as distance from the human activities listed above is increased. Noise sensitive receptors and noise sensitive areas in the project area include residences, lodging establishments, churches, and Trinidad Elementary School.

The California General Plan Guidelines include guidelines for noise-compatible land uses. The existing General Plan contains a table, Noise and Land Use Compatibility Guidelines, which are consistent with the current state guidelines. The Land Use Noise Compatibility Matrix within Trinidad's Draft Noise & Safety Element specifies that the hourly Leq of 45 dB Leq indoors and 55 dB Leq outdoors are the maximum level below which there are no effects on public health and welfare for residences, lodging, commercial and nursing homes; however, higher outdoor levels are identified as "normally acceptable" (60 to 70 dB Ldn) and "normally unacceptable" (70-80 dB Ldn). For libraries, schools and churches the hourly Leq of 45 dB indoors and 55 dB Leq outdoors are the noise level performance standards for new projects affected by or including stationary sources.

a, c, d) Exposure to Noise in Excess of Established Standards or Substantially Increase Existing Levels – Less than Significant

Construction

The construction phase of the project would require the use of heavy equipment for open trench excavation and would temporarily increase ambient noise levels for the duration of the project. Construction activities would also involve the use of smaller power tools, generators, and other sources of noise. During construction, noise levels would vary based on the amount of equipment in operation and the location of the activity. With regard to any given point at the various LID/BMPs stormwater improvement locations, the loudest construction operations would occur for only the limited duration of up to approximately one to two weeks during the day. Noise levels would be consistent with the reference noise levels in Table 3.2: Construction Equipment Reference Noise Levels as Measured at 50 feet, below.

Table 3.2: Construction Equipment Reference Noise Levels as Measured at 50 feet

Equipment	Noise Level (dB[1])	Equipment	Noise Level (dB)
Drill rig truck	84	Jackhammer	85
Horizontal Boring Hydraulic Jack	80	Large Generator	82
Front end loader or Backhoe	80	Paver or Roller	85
Excavator	85	Dump truck	84

Source: FHWA, 2006.
[1]"dB" is a weighted decibel measurement for assessing hearing risk and, therefore, is used by most regulatory compliance.

Sound from a point source is known to attenuate at a rate of -6 dB for each doubling of distance. For example, a noise level of 84 dB L_{eq} as measured at 50 feet from the noise source would attenuate to 78 dB L_{eq} at 100 feet from the source and to 72 dB L_{eq} at 200 feet from the source to the receptor. Based on the reference noise levels, above, the noise levels generated by construction equipment at the project site may reach a maximum of approximately 85 dB L_{eq} at 50 feet during site excavation, construction, and repaving disturbed streets. The closest sensitive receptors are neighboring homes, churches and Trinidad Elementary School near where LID/BMPs stormwater improvements are planned. These uses would be in close proximity to construction equipment and open trench construction using backhoes, excavators, paving equipment, compactors, and rollers.

Construction in front of the school will primarily occur during the summer, and so will not take place during school hours. It is possible that some of the residences in Trinidad would experience exterior noise levels near the full reference levels (up to 85 dB L_{eq}) listed in Table 3.2: Construction Equipment Reference Noise Levels as Measured at 50 feet, above, because a few of the homes on these streets are within approximately 100 feet of project activities or closer. A typical building can reduce noise levels by 15 to 25 dB with the windows closed (Humboldt County 1984, U.S. EPA 1974), thereby reducing interior noise levels within the closest homes (25 feet) to approximately 60 to 70 dB L_{eq}. These levels would be higher than the US EPA maximum recommended interior (45 L_{dn}) and exterior noise (55 L_{dn}) levels below which there are "no effects on public health and welfare." The construction noise would likely predominantly fall in to the "normally acceptable" (60 to 70 L_{dn} exterior) and "normally unacceptable" (70 to 80 L_{dn} exterior) range, as identified in the General Plan guidelines. As such, the closest residences would likely experience construction noise levels in excess of noise standards for residential use (albeit temporary, one to two weeks during the day for any given residence).

To avoid and minimize adverse effects to sensitive noise receptors, Environmental Protection Action 5, *Noise Reduction Actions*, has been incorporated into the project. Under Environmental Protection Action 5 sound abatement actions such as construction hour limitations, and equipment muffler/maintenance requirements will be implemented. With the implementation of Environmental Protection Action 5, construction noise would be limited in duration and intensity such that construction noise at sensitive receptors would be less than significant. Additionally, there would be no construction on weekends except with permission from the City as needed to keep the project on schedule.

Operation

Noise at the project site during operation and maintenance will not measurably exceed the existing background noise levels because only infrequent vehicular access, minor repairs, and maintenance would be required. A less than significant impact would occur.

b) Exposure to Groundborne Vibration or Noise – Less than Significant Impact

Construction would cause temporary vibration in the immediate vicinity of the active portion of the construction site. Vibration would predominantly be caused by trenching equipment, excavation equipment, and compaction equipment. Vibration from on-site construction activities would typically be intermittent during a short duration, and operation would likely be more continuous through the working day. Based upon the types of anticipated construction equipment, and because no pile driving or blasting is needed, ground-borne vibration levels produced during project construction are not expected to have a significant impact on sensitive receptor locations. The restriction of working hours under Environmental Protection Action 5 would eliminate the impact of trenching equipment-generated vibration during night-time, early morning, and evening hours when people are generally more sensitive to noise and vibration. Therefore, a less than significant impact would occur related to ground-borne vibration or ground-borne noise levels.

e, f) Exposure of People Residing or Working Near a Private or Public Airport to Excessive Noise Levels – No Impact

There are no public or private airports within two miles of the project. The nearest public airport, Arcata-Eureka Airport, is located approximately eight miles south of the project area. The project would not result in any changes to the noise levels related to an airport or private airstrip. No impact would occur.

3.13 Population and Housing

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?				✓
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?				✓
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?				✓

3.13.1 Discussion

The City of Trinidad is comprised of primarily single-family homes with a few multifamily units. The 2013 Department of Finance population estimate for Trinidad was 365 persons, up 0.3 percent from 2012.

a) Induce Substantial Population Growth – No Impact

The overall purpose of the project is to modernize the City stormwater system through incorporation of LID/BMPs to capture, treat, and infiltrate stormwater runoff. The project would not create any housing nor necessitate the development of housing. It would not result in the extension of utilities or roads or other infrastructure into outlying or exurban areas and would not directly or indirectly lead to the development of new sites that would induce population growth. No impact has been identified.

b, c) Displace Housing or People – No Impact

The project would not result in the displacement of any housing or people. No impact would occur.

3.14 Public Services

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire Protection?				✓
Police protection?				✓
Schools?				✓
Parks?				✓
Other public facilities?				✓

3.14.1 Discussion

For the 15 square miles of the Trinidad Planning Area, there are two volunteer fire departments, one in Trinidad proper and the other in Westhaven. CalFire is also stationed on Patrick Point Drive and they respond to emergencies like wildland and structure fires, floods, earthquakes, hazardous material spills, and medical aids. Mutual aid agreements exist between all of the stations (City of Trinidad 2012). The Humboldt County Sherriff's Office is contracted with the City of Trinidad for police response. The closest school is Trinidad Elementary School on Trinity Street in Trinidad served by the Trinidad Union School District. Open Space lands include public agency open space lands, parklands, the Tsurai Village Site, beaches, and near and off-shore rocks.

a – e) Substantial Adverse Physical Impacts Associated with New or Altered Fire or Police Protection, Schools, Parks, or other public facilities – No Impact

As discussed in Section 3.13.1 a), the project would not directly or indirectly induce population growth nor create new demand for services. Therefore, the project would have no impact on the service ratios, response times, or other performance objectives of schools, parks, and other public facilities that are based on population growth. The project would not require a new or physically altered government facility to serve the project site. No impact would occur.

3.15 Recreation

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?			✓	
b) Include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?				✓

3.15.1 Discussion

According to the City of Trinidad General Plan, activities available to local residents include recreational and educational programs at the elementary school, fraternal organization activities, sport fishing, beachcombing, hiking, picknicking, sightseeing, and related activities. Fishing is one of the primary attractions for visitors coming to Trinidad.

Publicly owned recreation areas in the project area include the school and its playground areas, City Hall (which is used for social and fraternal functions), the adjacent tennis court, Saunder's Park, Trinidad Head, Trinidad Beach State Park, and other public beaches. Public access to the harbor and beaches is via Edwards Street.

a) Increase in the Use of Existing Facilities Resulting in Substantial Physical Deterioration – Less than Significant Impact

As discussed in Impact 3.13.1 a) (Population and Housing), the project would not directly or indirectly induce substantial population growth. Therefore, the project would not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. Construction of the project within ROW during the summer tourism season could interfere with recreational use and access to the coastline. A traffic control plan will be developed that maintains access to all areas of the City, including the coastline and recreational areas though the use of detours or one-lane closures. See Section 3.16 Transportation/Traffic below for more information. The impact is less than significant.

b) Development of Recreation Facilities that Could Result in Adverse Physical Effects on the Environment – No Impact

The project would not include recreational facilities. As discussed in Impact 3.13.1 a) (Population and Housing), the project would not directly or indirectly induce substantial population growth. Therefore, the project would not require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment. No impact would occur.

3.16 Transportation/Traffic

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

3.16.1 Discussion

In the City there are approximately 6.27 miles of paved, impermeable roadway. The majority are narrow, local streets, with the exception of Trinity, Main and Edwards Streets that wind through the Commercial and Planned Development /Mixed Use district and provide access to the Harbor and beaches. Trinidad residents are dependent on a single highway (U.S. Highway 101) for access to major services, employment, and commercial areas. Highway 101 also facilitates visitor access to Trinidad (City of Trinidad 2012).

a) Conflict with an Applicable Plan, Ordinance, Policy, or Program Establishing Measures of Effectiveness for the Performance of the Circulation System – Less than Significant with Mitigation

Project activities would generate temporary construction-related traffic and lane/road closures, including: 1) passenger vehicles transporting construction and inspection workers to and from the site, 2) heavy trucks/haulers accessing the site to deliver materials and remove trash and debris, and 3) partial lane/road closures during construction. Road closures are anticipated for Main and Trinity Streets during construction of the infiltration basins due to the depth and width of excavation required. Construction along Main and Trinity Streets would take approximately three weeks. Only one lane of travel will need to be shut down on Main and Trinity Streets during installation of the proposed storm drain lines. One lane of travel can be kept open on side streets (View Ave, Ocean Ave, etc.) during construction, which will allow access to all areas of the community.

Project activities would have an anticipated duration of approximately 240 calendar days maximum (summer/fall 2014), assuming five work days per week from the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday, and not on weekends except with permission from the City as needed to keep the project on schedule. Because of the temporary nature of project activities, including vehicle/truck trips and construction duration, project activities would not create a substantial increase in traffic on roads within the project area and on Highway 101.

Given the low traffic level on Trinidad roadways mid-week, and the availability of alternate routes for travel through Trinidad's residential neighborhood, the potential impacts to motor vehicles, pedestrians, and bicyclists would be minor. Additionally, construction would not take place on Trinity Street while school is in session or during the Trinidad Fish Festival. To ensure alternate routes remain open and accessible throughout construction, it will be necessary to implement a traffic control plan to ensure that detours are clearly indicated and traffic flow is maintained. Implementation of Mitigation Measure TR-1 would reduce potentially significant impacts to less than significant.

- **Mitigation Measure TR-1: Traffic Control Plan**

  In coordination with the City of Trinidad, the construction contractor shall develop an approved traffic control plan prior to the commencement of construction. Elements of this plan shall be implemented as necessary and appropriate for construction. The plan shall include, but not be limited to:

  - Adherence to City and Caltrans traffic management standards.
  - Location(s) of designated project construction staging area(s) for equipment/materials storage and construction worker parking.
  - Temporary replacement parking for residents during the construction period, if needed.
  - Detour routes will be used in order to maintain access throughout the City and to the coastline during project construction.
  - Use of flagging and signage during construction of LID/BMPs stormwater improvements, materials delivery, and/or movement of construction equipment in any private or public roadway.
  - Provisions to maintain unobstructed access for law enforcement, fire department, or other official or emergency personnel and vehicles.

With implementation of Mitigation Measure TR-1, potential impacts on traffic circulation attributable to the project would be reduced to a less than significant level.

b) Conflict with an Applicable Congestion Management Program – No Impact

The project area is not subject to a Congestion Management Program (CMP) and does not have a traffic congestion problem during weekday work hours, with all area streets and roads below capacity; therefore, there would be no impact.

c) Result in a Change in Air Traffic Patterns – No Impact

The nearest public airport, Arcata-Eureka Airport, is located approximately eight miles south of the project area. No aspect of the project would affect air traffic patterns; therefore, there would be no impact.

d) Substantially Increase Hazards due to a Design Feature or Incompatible Use – Less than Significant with Mitigation

The project would not change the geometry of the street or roadway network in Trinidad. Therefore, no potentially hazardous roadway design features would be introduced by the project.

As discussed above, the presence of construction vehicles and equipment on nearby roadways could increase the normal traffic hazard in the project area. The project would require traffic safety control procedures to accommodate traffic during construction. Weekday work hours would be confined to 7:00 am to 7:00 pm, Monday through Friday, and not on weekends except with permission from the City as needed to keep the project on schedule. Construction equipment and delivery trucks would access the project area from Main Street via Highway 101. Construction vehicles would generally not be parked to block public ROW. Therefore, the following mitigation measure is presented to prevent interferences to emergency vehicles and/or conflict between day-to-day traffic and project construction activities.

- **Mitigation Measure TR-1: Traffic Control Plan**

  Refer to Impact 3.16.1 a), above, for text of Mitigation Measure.

With implementation of Mitigation Measure TR-1, potential project impacts to emergency access and/or potential conflict with traffic operations would be reduced to a less than significant level.

e) Result in Inadequate Emergency Access – Less than Significant with Mitigation

The project is located within the city limits of the City of Trinidad, on the west side of Highway 101. The project will not substantially alter the existing emergency access and the likelihood of a need for emergency services in this area is very low. Construction would primarily take place in the public ROW near the edge of pavement. This would allow emergency vehicles to pass without disruption. Highway 101 would not be affected by construction and operation of the project.

During construction; however, temporary lane/road closures should be coordinated such that emergency access is maintained at all times.

- **Mitigation Measure TR-1: Traffic Control Plan**

  Refer to Impact 3.16.1 a) above for text of Mitigation Measure.

With implementation of TR-1 above, which addresses the maintenance of access to the police and fire departments, this potential access impact would be considered less than significant.

f) Conflict with Adopted Policies, Plans, or Programs Regarding Public Transit, Bicycle, or Pedestrian Facilities, or Otherwise Decrease the Performance or Safety of Such Facilities – No Impact

The adopted Trinidad General Plan is the guiding document addressing alternative transportation in the project area and Planning Area of Trinidad. The project would not conflict with policies nor adversely affect facilities for public transit, bicycles, or pedestrians. There would be no impact.

3.17 Utilities and Service Systems

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

3.17.1 Discussion

Wastewater

According to the City of Trinidad Draft Public Services Element, the City of Trinidad does not have a centralized sewer system, and instead relies entirely on individual on-site wastewater treatment systems (OWTS). Because septic tanks are the most feasible type of individual wastewater disposal system available at the present time, residential land uses are limited to those types that are consistent with the community's development preferences and can best be adapted to the service constraints of septic tank systems (City of Trinidad 2012).

Stormwater

According to the City of Trinidad Draft Public Services Element, stormwater originating in the northern portion of the City is routed through a series of roadside ditches, drain inlets, and culverts which discharge to the Mill Creek drainage. Stormwater originating in the central portion of the City of Trinidad watershed is also routed through a series of roadside ditches, drain inlets, and culverts to the TR1032 stormwater outfall. Some areas, such as

Wagner Street, have no curbs or drain inlets, so drainage is generally south towards the bluff areas or towards Parker Creek. Stormwater from the HSU Telonicher Marine Lab (TML) is also routed in a storm drain that parallels the City's stormwater system and discharges to Trinidad Bay near the Rancheria's boat launching facility (City of Trinidad 2012).

Water Service

According to the City of Trinidad Draft Public Services Element, the City of Trinidad operates a municipal water supply system that services the occupied parcels within the City and a number of properties outside the City limits. Potable water for the City system is currently supplied from Luffenholtz Creek located two miles south of the City. The water system includes an infiltration gallery, water treatment plant and several storage tanks. The City also has some unused water rights on Mill Creek (City of Trinidad 2012).

Solid Waste

According to the City of Trinidad Draft Public Services Element, Humboldt Sanitation and Recycling currently contracts their services for garbage pickup with residents, businesses and public service municipalities. Most refuse is transferred to a municipal transfer station and then hauled out of state where it is disposed in, for example, the Dry Creek landfill in Oregon. There is no local landfill since the Cummings Road landfill reached capacity. Other alternatives are currently being pursued (City of Trinidad 2012).

a, e) Exceed Applicable Wastewater Treatment Requirements or Wastewater Treatment Capacity – Less than Significant Impact

The project would modernize the City stormwater system through incorporation of LID/BMPs to capture, treat, and infiltrate stormwater runoff. The project would not cause any increase or change in wastewater and would therefore not have an impact on wastewater treatment requirements or capacity.

As noted previously, a groundwater model was used to simulate stormwater infiltration below ground at the proposed underground infiltration basin locations to verify that the area could accommodate increased infiltration without detrimental impacts to streams, septic systems and bluff stability. Groundwater modelling results were reviewed by Engineers at Crawford & Associates, Inc. and HydroGeoLogic Inc. to verify that the locations and quantities of stormwater infiltration will not impact the performance of septic systems, compromise bluff stability, or cause significant changes to flows in nearby streams. Technical memorandums from both Crawford & Associates, Inc. and HydroGeoLogic Inc. describing their findings are included in Appendix C and Appendix D, respectively. The impact would be less than significant.

b, c) Require Construction or Expansion of New Water, Wastewater, or Stormwater Facilities – Less than Significant Impact

The proposed project will not require construction or expansion of new water, wastewater or stormwater facilities, which would cause significant environmental effects. The project will implement LID/BMPs to capture, treat, and infiltrate stormwater runoff, thereby improving the stormwater system in the City of Trinidad, and reducing pollutants from reaching area waterways and the ASBS. The project has been designed to minimize the need for future maintenance. The impact is less than significant.

d) Have Sufficient Water Supplies to Serve the Project – No Impact

The project would not increase the capacity or demand of the potable water system. No additional water supply is necessary to serve the proposed project. No impact would occur.

f, g) Have Sufficient Landfill Capacity and Comply with Statutes Related to Solid Waste – Less than Significant Impact

The project would generate a small volume of construction waste that would be hauled by the construction contractor to an approved disposal site. Waste would include construction materials remnants, replaced materials, and worker-generated trash and debris. This would be a less than significant impact on landfill capacity with the adherence to federal, state, and local statutes and regulations related to solid waste.

3.18 Mandatory Findings of Significance

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
Would the project:				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?		✓		
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?			✓	
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?		✓		

3.18.1

a, c) Degrade Environmental Quality or Adversely Affect Human Beings – Less than Significant with Mitigation

With implementation of the Environmental Protection Actions and Mitigation Measures presented herein, the project as a whole does not have the potential to significantly degrade the quality of the environment, including air quality, fish or wildlife species or their habitat, plant or animal communities, important examples of the major periods of California history or prehistory, geologic resources, hazards, water resources, land use compatibility, noise, traffic movement, or other adverse effects, directly or indirectly, on human beings.

b) Cumulatively-Considerable Impacts – Less than Significant Impact

The project's individual impacts would not add appreciably to any existing or foreseeable future significant cumulative impact, such as visual quality, historic resources, traffic impacts, or air quality degradation. Incremental impacts, if any, would be negligible and undetectable. As reported throughout the document, cumulative impacts to which this project would contribute would be mitigated to a less than significant level. In fact, the project has been designed to reduce some of the cumulative impacts of increased impervious surfaces and resulting stormwater runoff that have occurred over time with development in Trinidad.

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Appendix A

Mitigation, Monitoring, and Reporting Plan (to be included prior to adoption)

Appendix B

Infiltration Analysis by Sub-Basin

City of Trinidad
ASBS Stormwater Improvement Project
Infiltration Analysis by Sub-Basin

Results:				Constants:			Green-Ampt*			References:
Vtank (ft^3)	h (ft)	Vtank Max (ft^3)	hmax (ft)	Area (ft^2):	Ks** (ft/min):	Depth to Bedrock** (ft):	Ψf* (ft)	θs*	θi*	* Hydrology and Hydraulic Systems, Third Edition, Gupta, 2008.
16,392	1.87	21,372	1.87	11,400	0.04	50	0.0151	0.3000	0.1200	** City of Trinidad ASBS Stormwater Improvement Project, Geotechnical Analysis, GHD, October 2012.

Hydrograph:						Calculations:							
	CT-1 (ft^3/s)	CT-2 (ft^3/s)	CT-3 (ft^3/s)			Volumetric:			Green-Ampt*				
Date/Time	50-year	50-year	50-year			Vrunoff (ft^3)	Vtank (ft^3)	h (ft)	zf (ft)	q (ft/min)	F (ft)	Vinf (ft^3)	actual (ft^3)
1/1/2012 0:00	0.00	0.00	0.00										
1/1/2012 0:01	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2012 0:02	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2012 0:03	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2012 0:04	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/1/2012 0:05	0.00	0.10	0.00			6.00	6.00	0.00	0.03	0.01	0.01	64.06	6.00
1/1/2012 0:06	0.00	0.10	0.00			6.00	6.00	0.00	0.33	0.05	0.05	615.47	6.00
1/1/2012 0:07	0.00	0.10	0.00			6.00	6.00	0.00	0.54	0.04	0.04	429.62	6.00
1/1/2012 0:08	0.00	0.10	0.00			6.00	6.00	0.00	0.75	0.04	0.04	422.12	6.00
1/1/2012 0:09	0.10	0.10	0.10			18.00	18.00	0.00	0.95	0.04	0.04	419.44	18.00
1/1/2012 0:10	0.10	0.10	0.10			18.00	18.00	0.00	1.15	0.04	0.04	417.47	18.00
1/1/2012 0:11	0.10	0.10	0.10			18.00	18.00	0.00	1.36	0.04	0.04	416.20	18.00
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1/1/2012 0:13	0.10	0.10	0.10			18.00	18.00	0.00	1.76	0.04	0.04	414.66	18.00
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1/1/2012 0:26	0.20	0.20	0.10			30.00	30.00	0.00	4.38	0.04	0.04	412.01	30.00
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1/1/2012 0:29	0.20	0.20	0.10			30.00	30.00	0.00	4.98	0.04	0.04	411.79	30.00
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1/1/2012 0:31	0.20	0.20	0.10			30.00	30.00	0.00	5.38	0.04	0.04	411.68	30.00
1/1/2012 0:32	0.20	0.20	0.20			36.00	36.00	0.00	5.58	0.04	0.04	411.66	36.00
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1/1/2012 0:52	0.30	0.20	0.20			42.00	42.00	0.00	9.59	0.04	0.04	411.09	42.00

Northeast Trinidad

Scenario 1:

Watershed:	CT-1, CT-2 & CT-3	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	100 year, 24 hour	Contech Con/Span	40,000	8,300	65	16.00	6.00	521	19.67
Location:	Main Steet	Contech Chambermaxx	26,000	13,900	311	6.28	2.50	2,218	6.28

Scenario 2:

Watershed:	CT-1, CT-2 & CT-3	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	50 year, 24 hour	Contech Con/Span	34,300	7,000	55	16.00	6.00	441	19.67
Location:	Main Steet	Contech Chambermaxx	21,400	11,400	255	6.28	2.50	1,820	6.28

Scenario 3:

Watershed:	CT-1, CT-2 & CT-3	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	25 year, 24 hour	Contech Con/Span	28,700	6,000	47	16.00	6.00	377	19.67
Location:	Main Steet	Contech Chambermaxx	17,800	9,500	213	6.28	2.50	1,521	6.28

Scenario 4:

Watershed:	CT-1, CT-2 & CT-3	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	2 year, 24 hour	Contech Con/Span	13,600	2,800	22	16.00	6.00	177	19.67
Location:	Main Steet	Contech Chambermaxx	8,000	4,300	96	6.28	2.50	688	6.28

North Trinidad

Scenario 1:

Watershed:	CT-5	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	100 year, 24 hour	Contech Con/Span	11,900	2,300	18	16.00	6.00	145	19.67
Location:	Main Steet	Contech Chambermaxx	6,800	3,600	81	6.28	2.50	582	6.28

Scenario 2:

Watershed:	CT-5	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	50 year, 24 hour	Contech Con/Span	9,800	1,900	15	16.00	6.00	121	19.67
Location:	Main Steet	Contech Chambermaxx	5,700	3,000	68	6.28	2.50	489	6.28

Scenario 3:

Watershed:	CT-5	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	25 year, 24 hour	Contech Con/Span	8,000	1,600	12	16.00	6.00	97	19.67
Location:	Main Steet	Contech Chambermaxx	4,600	2,500	55	6.28	2.50	397	6.28

Scenario 4:

Watershed:	CT-5	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	2 year, 24 hour	Contech Con/Span	3,600	800	6	16.00	6.00	49	19.67
Location:	Main Steet	Contech Chambermaxx	2,100	1,100	25	6.28	2.50	183	6.28

Central Trinidad

Scenario 1:

Watershed:	CT-4, CT-6, CT-7	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	100 year, 24 hour	Contech Con/Span	28,000	5,200	41	16.00	6.00	329	19.67
Location:	Main Steet	Contech Chambermaxx	16,600	8,900	198	6.28	2.50	1,414	6.28

Scenario 2:

Watershed:	CT-4, CT-6, CT-7	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	50 year, 24 hour	Contech Con/Span	24,200	4,500	35	16.00	6.00	281	19.67
Location:	Main Steet	Contech Chambermaxx	14,000	7,500	167	6.28	2.50	1,194	6.28

Scenario 3:

Watershed:	CT-4, CT-6, CT-7	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	25 year, 24 hour	Contech Con/Span	20,600	3,800	30	16.00	6.00	241	19.67
Location:	Main Steet	Contech Chambermaxx	11,700	6,200	140	6.28	2.50	1,001	6.28

Scenario 4:

Watershed:	CT-4, CT-6, CT-7	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	2 year, 24 hour	Contech Con/Span	9,700	1,800	14	16.00	6.00	113	19.67
Location:	Main Steet	Contech Chambermaxx	5,100	2,800	61	6.28	2.50	439	6.28

South Trinidad

Scenario 1:

Watershed:	CT-8, CT-9	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	100 year, 24 hour	Contech Con/Span	16,600	3,100	24	16.00	6.00	193	19.67
Location:	Main Steet	Contech Chambermaxx	9,700	5,200	116	6.28	2.50	831	6.28

Scenario 2:

Watershed:	CT-8, CT-9	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	50 year, 24 hour	Contech Con/Span	14,100	2,700	21	16.00	6.00	169	19.67
Location:	Main Steet	Contech Chambermaxx	8,000	4,400	96	6.28	2.50	688	6.28

Scenario 3:

Watershed:	CT-8, CT-9	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	25 year, 24 hour	Contech Con/Span	11,600	2,200	17	16.00	6.00	137	19.67
Location:	Main Steet	Contech Chambermaxx	6,600	3,600	79	6.28	2.50	567	6.28

Scenario 4:

Watershed:	CT-8, CT-9	Technology:	Storage Volume (ft^3):	Infiltration Area (ft^2)	No. Units:	Unit Width (ft):	Unit Height (ft):	Total Length (ft):	Total Width (ft):
Storm Size:	2 year, 24 hour	Contech Con/Span	4,900	1,000	8	16.00	6.00	65	19.67
Location:	Main Steet	Contech Chambermaxx	2,800	1,500	33	6.28	2.50	240	6.28

Appendix C

Slope Stability Analysis

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Sacramento • Modesto • Roseville • Pleasanton

October 3, 2013

Mr. Patrick Sullivan
GHD
718 Third Street
Eureka, CA 95501-0417

Subject: **Slope Stability Analyses**
Trinidad Stormwater Improvement Project
Trinidad, California

Dear Mr. Sullivan,

Crawford & Associates, Inc. (CAInc) completed slope stability analyses along selected bluff sections using SLIDE software by RocScience. Our analyses were based on the cross-section geometry for Sections H-H', AB-AB', and G-G' as provided by GHD. Comparisons were made between water surface elevations under existing conditions and under maximum (peak) infiltration based on a 50-year storm, per GHD hydrologic data.

CAInc assigned strength parameters of ϕ=30° and a cohesion = 200 psf to the near surface terrace soils (silty sand and poorly graded sand). These parameters are supported by GHD boring and laboratory data and our field observations of the relatively strong, Pleistocene marine terrace soils as exposed along the bluff face (near-vertical in some places, reflecting their partly cemented nature). The underlying bedrock is comprised of highly sheared, greywacke sandstone of the late Mesozoic Franciscan Formation; we assigned strength parameters of ϕ=42° and a cohesion = 1000 psf to the bedrock formation.

We analyzed each section to determine the critical failure surface, recognizing that the south bluffs along Trinidad Bay (Sections G.1-G.1' and H-H') have experienced past failures within the terrace soils. Section AB-AB' evaluated the west slope facing the ocean. We also field-reviewed the north slope discharging to a tributary of Mill Creek.

Our computed minimum factors of safety (FS) for the existing slopes range from 1.22 to 2.09. The added hydraulic head as shown by GHD groundwater modeling for the 50-year storm condition (short-term, transient model) reduces the Factors of Safety to 1.05 (G.1-G.1') to 2.92 (AB-AB').

We summarize our results in Table 1 below, show the stability plots on Figure 1 through 6, and show the cross section locations on Figure 7.

Table 1: Slope Stability Results			
Cross Section[1]	Minimum Factor of Safety		
	Existing Condition	50-year Storm Condition	Reduction
H-H'	1.24	1.15	7%
G.1-G.1' Plus 25 Cells West	1.22	1.05	14%
AB-AB'	2.09	1.92	8%

[1]We show the cross section locations on Figure 7.

Our analyses show a relatively small (about 14% or less) reduction in FS at the 50-year storm event. Based on our discussion with GHD we understand that the 50-year event will cause a peak groundwater level for only a few hours in duration. We consider the reduced factor of safety to be acceptable for these short (transient) periods of time. We also compared the (50-year storm) condition at section G-G' (FS=1.05) with a more typical, 2-year storm profile; these results show a FS of 1.14.

At the Mill Creek tributary, our review indicated this drainage to be relatively steep and heavily vegetated, with the slope comprised of terrace soils similar to the bluffs. We did not observed evidence of significant instability along these slopes. We do not anticipate the short-term increase in hydraulic head to have an adverse impact to these slopes.

LIMITATIONS

CAInc prepared this report in accordance with generally accepted geologic and geotechnical engineering principles and practices currently used in this area. This report is based on data provided by GHD at specific bluff locations. The input parameters represent a simplified model using the limited data and conditions at other locations may be different. This report should be reviewed and modified if conditions change or if further data is made available.

Crawford & Associates, Inc.

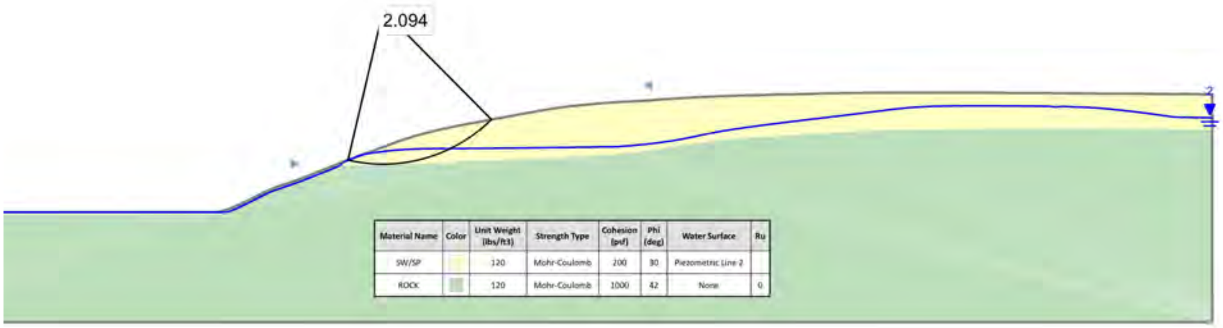
REGISTERED PROFESSIONAL ENGINEER
BENJAMIN D. CRAWFORD
No. GE 2861
GEOTECHNICAL
STATE OF CALIFORNIA

Rick Sowers, P.E., C.E.G.
Principal

Benjamin Crawford, P.E., G.E.
Principal

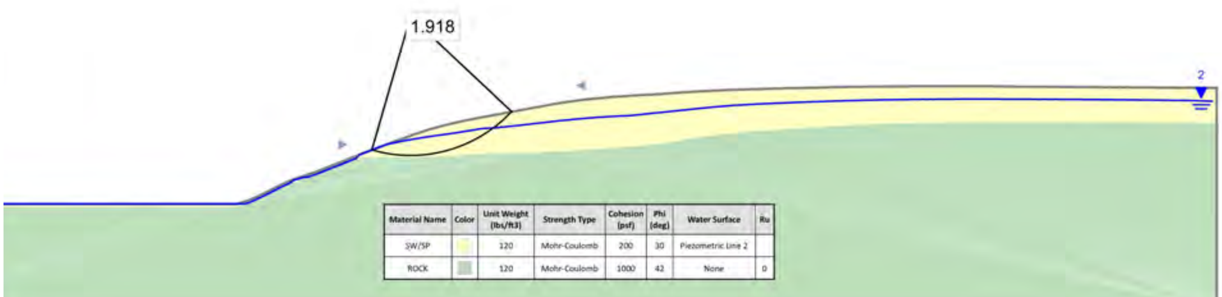
Attachment: Figure 1 through 6, Slope Stability Trials
Figure 7, Cross Section Locations

Slope Stability Trials



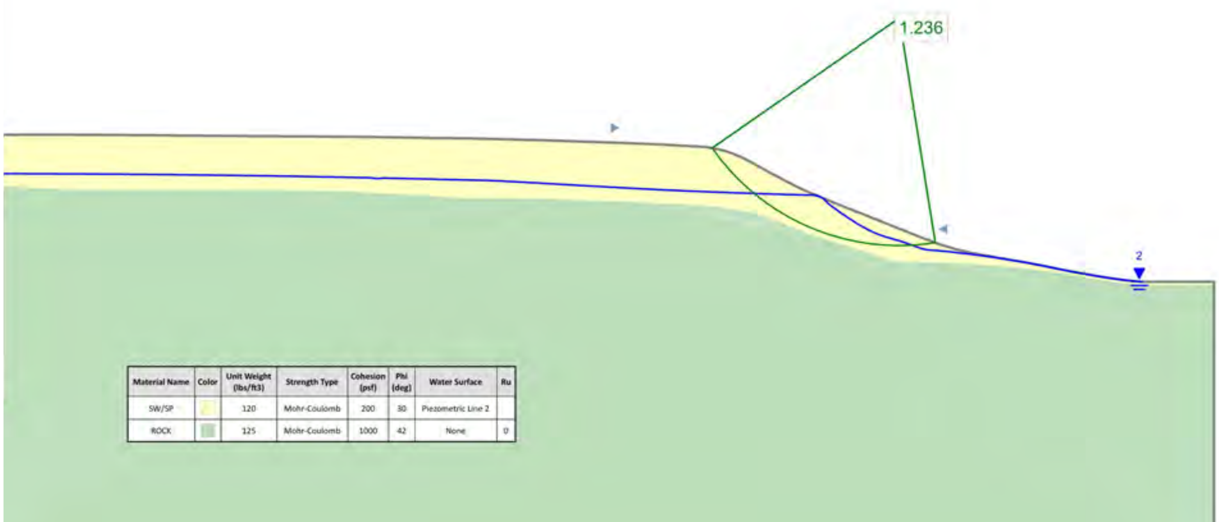
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
SW/SP		120	Mohr-Coulomb	200	30	Piezometric Line 2	
ROCK		120	Mohr-Coulomb	1000	42	None	0

Figure 1: AB-AB' Existing Condition



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
SW/SP		120	Mohr-Coulomb	200	30	Piezometric Line 2	
ROCK		120	Mohr-Coulomb	1000	42	None	0

Figure 2: AB-AB' Proposed Condition



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
SW/SP		120	Mohr-Coulomb	200	30	Piezometric Line 2	
ROCK		125	Mohr-Coulomb	1000	42	None	0

Figure 3: H-H' Existing Condition

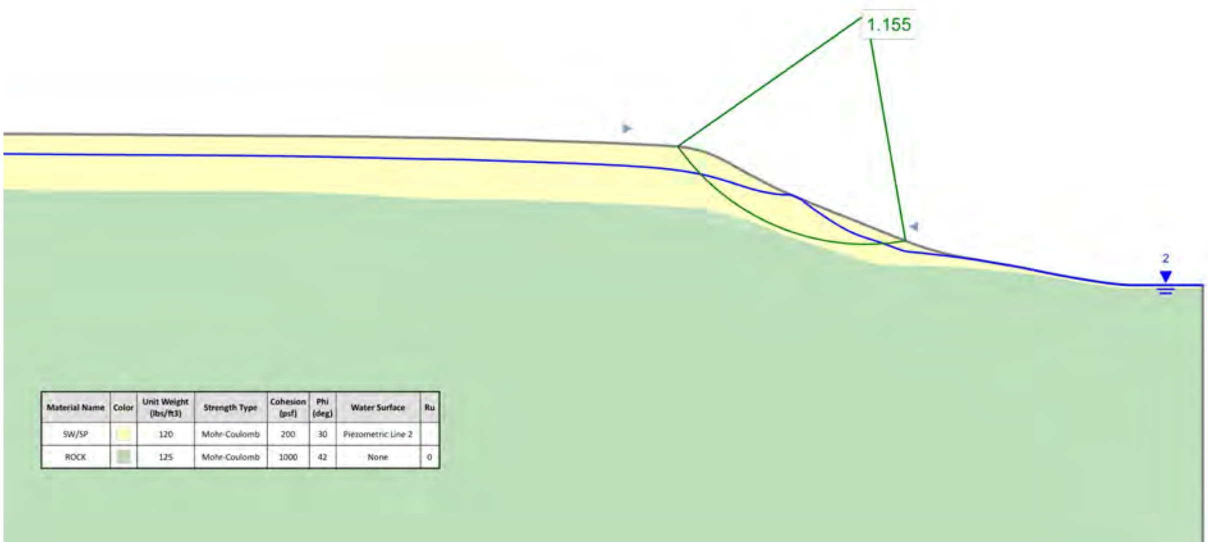


Figure 4: H-H’ Proposed Condition

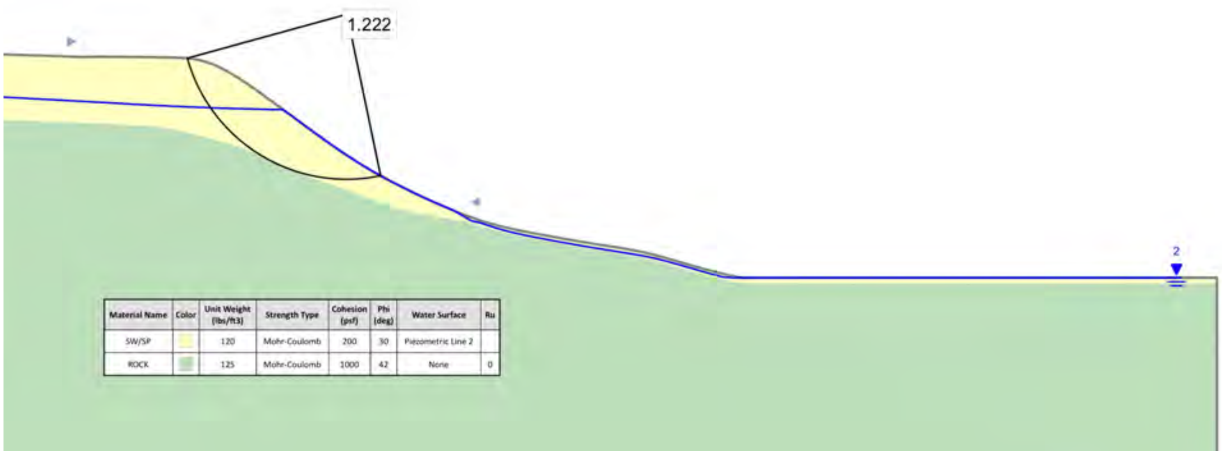


Figure 5: G.1-G.1’ Plus 25 Cells West Existing Condition

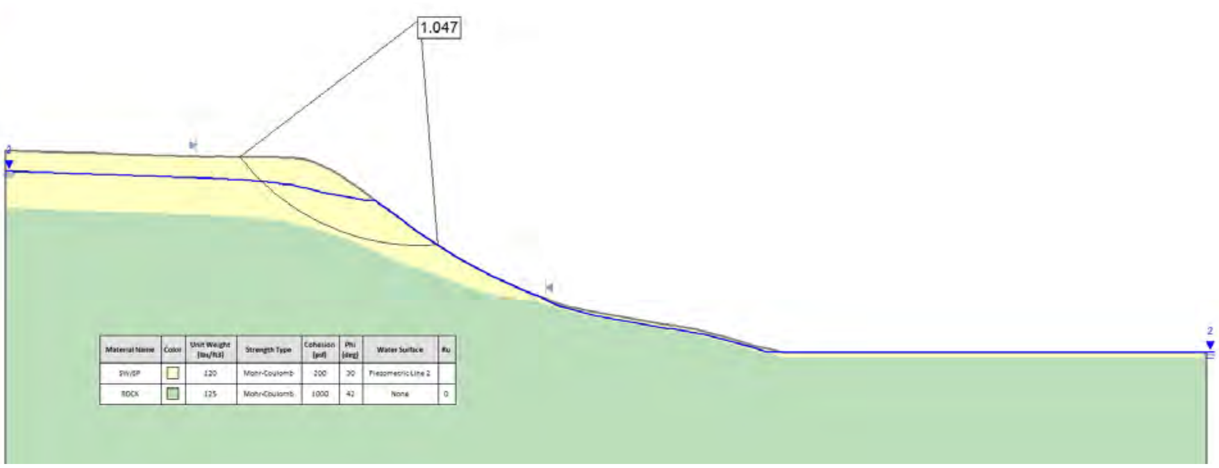


Figure 6: G.1-G.1’ Plus 25 Cells West Proposed Condition

Figure 7: Cross Section Locations

Appendix D

Trinidad Groundwater Model Review

HGL HydroGeoLogic, Inc
Exceeding Expectations

Memorandum

TO: Patrick Sullivan, GHD

FROM: Varut Guvanasen, HGL

DATE: September 5, 2013

SUBJECT: Trinidad Model Review

SUMMARY

A review of the City of Trinidad groundwater model was conducted and is summarized in this memorandum. The model was found to be consistent with the conceptual model outlined in the Geotechnical Analysis Report (GHD, 2012). The model was calibrated with observed potentiometric elevations in a steady-state mode. The model is considered technically appropriate for applications in engineering design and evaluation. It is also recommended that sensitivity analysis be conducted to bracket the model's predictive limits.

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1. BACKGROUND

The City of Trinidad (the City) is undertaking a project to make changes to the City stormwater drainage system. The objective of the City's Stormwater System Project is to capture and treat stormwater runoff from rainfall events by redirecting the runoff into underground infiltration galleries constructed in multiple locations within the City. The new stormwater system will replace the City's existing stormwater system, initially constructed in the early 1970's, discharges to a single 32-inch stormwater outfall, which discharges to Trinidad Bay.

GHD has developed a groundwater model to simulate groundwater flow within the City of Trinidad and surrounding areas. The model has been calibrated using observed groundwater elevation data and subsequently utilized to assess the impact due to implementation of infiltration galleries. As part of GHD's QA/QC program, HGL was contracted to review the model developed to ensure that the simulation code (MODFLOW-SURFACT (HGL, 2011)) was appropriately applied and the that the results are consistent with observed data.

2. COMPUTER SIMULATION CODE

The groundwater flow modeling computer code MODFLOW-SURFACT (HGL, 2011) was used for the simuation of groundwater flow for the model area. MODFLOW-SURFACT is an enhanced version of the USGS modular three-dimensional groundwater flow code (McDonald and Harbaugh, 1988). MODFLOW-SURFACT was selected because of the following capabilities and attributes:

- Compatibility with the USGS MODFLOW;
- Rigorous simulation of the free surface conditions in unconfined aquifers;
- Seepage face boundary capability; and
- Robust and numerically efficient flow equation solver.

Of special importance are the second, third, and fourth attributes. These attributes are important to a computationally efficient, robust and accurate solution to a relatively large model with relatively thin saturated zones in many areas in the marine terrace.

3. DOCUMENTS AND COMPUTER FILES

The following documents and computer files were provided to HGL:

- Geotechnical Analysis Report (GHD, 2012);
- Draft Report: Trinidad ASBS Stormwater Phase I (GHD, 2013a);
- Technical Note on septic tank loading rates (GHD, 2013b);
- Two sets of model input/output files:
    - o TrinRev2_Base (base case, steady state, one stress period)
    - o TransV2Des50 (50-year design, transient, 150 stress periods); and
- Water level vs time and daily precipitation plots at eight observation wells from November 2012 to May 2013.

4. CONCEPTUALIZATION

The groundwater model study area covers an area of 228 acres. The area includes the City of Trinidad, located in Humboldt County, CA, and surrounding areas. The study area is bound by Mill Creek to the north, Highway 101 and Parker Creek to the east, and the Pacific Ocean to the west and Trinidad Bay to the south. It is primarily covered by three watersheds: Mill Creek; the City of Trinidad; and Parker Creek.

The hydrogeology of the study area consists of (GHD, 2012):

- A Pleistocene unconfined sandy marine terrace aquifer generally composed of medium to well graded silty sands; underlain by
- Franciscan Complex bedrock.

The sandy aquifer is not currently used for extraction purposes, due to its low overall storage capacity, relatively shallow depth, and proximity to the residential septic systems. Depth to water table ranges from about 15 feet below ground surface (BGS) to 55 feet BGS across the study area, and is primarily controlled by the Fransciscan Complex bedrock.

Data for depth to bedrock were obtained from a total of 18 soil borings (identified as SB-1 to SB-18) across the study area to varying depths to provide an indication of the depth to bedrock and the terrace stratigraphy. The data were used to complement the bedrock elevation surface across the study area, developed as part of the *Geotechnical Analysis* (GHD, 2012).

In the sandy aquifer, the stratigraphy in the upper 3 to 5 feet to the surface is characterized by loose to compact disturbed and mixed fill materials of imported river gravel, sand, and silt (GHD, 2013a). Underlying the upper fill and silty sand layer, the majority of the subsurface materials encountered were generally dominated by loose, poorly graded, fine and medium-grained sand down to bedrock.

5. DEVELOPMENT AND CALIBRATION OF THE MODEL

5.1 Model Development

The model area was discretized into 6.56 x 6.56 ft cells aligned north-south, resulting in 465 rows and 495 columns to provide adequate resolution to model the septic tanks and the stormwater infiltration design options. The model was configured to simulate steady state conditions. The model grid used was considered adequately fine and appropriate for the inclusion of hydrologic and hydrogeologic features in the project area.

In order to simulate the septic tanks and stormwater infiltration design options, and provide adequate vertical resolution, the model was separated into five model layers. Layer 1 has a uniform thickness of 3 ft, which is the average depth below ground surface of septic tanks. Layers 2, 3, and 4 represent the unconfined sandy marine terrace. Layer 5, originally used to represent the Franciscan Complex bedrock or the aquitard, is inactive. In a given column, Layers 2, 3, and 4 are of identidcal thickness. The total thickness of these three layers varies across the model domain and ranges from 2 to 145 ft, with an average thickness of 45 ft.

The groundwater model boundary conditions are discussed below.

- Constant head boundaries: Constant head boundary conditions were applied to the model boundary cells in Layer 1 along the west and part of the southern boundary to mimic coastline. The constant-head cells along the coast were assigned a head of 0 ft MSL The constant-head cells adjacent to Highway 101 were assigned to the model in Layer 2. These cells were assigned a uniform head of 136 ft AMSL.
- Rivers: River boundary conditions were included in the model to simulate the flow of water into and out of the aquifer from Mill and Parker Creek (and tributaries). The river bed elevation was assigned as the layer 2 top elevation minus 0.33 ft, and was set to equal the stage height in order to prevent leakage from the River boundary to the aquifer. These water bodies were simulated as gaining streams only.
- Seeps: The regions identified as seeps in the Geotechnical Analysis Report (GHD, 2012) were classified as seepage face boundaries in the groundwater model.

- Septic Tanks: The septic tanks were incorporated into the groundwater model using injection wells to simulate fluxes into the model at the locations of respective septic systems. The injection wells were set in Layer 1 (based on the fact that septic system trenches are cut to around 3-4 feet deep), and each cell within a property's septic system was assigned a constant discharge rate.

- Recharge: Recharge was divided into three major zones: pervious (0.007 ft/day – 30.7 inches/year); impervious(0 ft/day); and high slope area (greater than 45°) (0.0007 ft/day – 3.1 inches/year).

5.2 Consistency between the Model and Observed Data

Potentiometric elevation data from nine observation wells were available from November 2012 to May 2013. The observed potentiometric elevations at these wells were relatively steady and their variation with time was relatively small. A comparison between the observed and simulated potentiometric elevations (from the base case) at these wells is given in Table 1 below. At all wells, except MW-3, water levels were continuously recorded every 15 minutes. At MW-3, water level was manually monitored twice during the period of observation.

Table 1 Comparison between the Simuulated and Observed Potentiometric Elevations

Well MW-	Observed (ft)		Average (ft)	Simulated (ft)	Difference (ft)
	High	Low			
1	13.4	8.8	11.1	10.7	0.4
2	65.5	62.0	63.4	63.4	0.1
3	84.6	81.5	83.1	80.9	2.1
4	137.7	133.8	135.3	138.2	-2.8
5	133.6	131.2	132.2	129.8	2.5
6	135.5	133.2	134.3	132.2	2.2
7	135.4	134.0	134.7	137.1	-2.5
8	132.5	131.5	132.0	129.0	3.0
9	117.8	116.6	117.2	117.6	-0.4
			Mean Error (ft)		0.5
			Mean Absolute Error (ft)		1.8
			Range (ft)		124.2

The comparison in Table 1 suggests that, based on the pseudo steady-state conditions between November 2012 to May 2013, the model favorably agrees with the observed data. The mean absolute error of 1.8 ft (1.5 percent of the range)is well within the normal criterion of 6.2 ft (5 percent of the range) and the mean error of 0.5 ft (0.4 percent of the range) indicates that the model bias is relatively small.

5.3 Discretization and Boundary Conditions

The following were verified/inspected:

- Vertical and horizontal discretization was verified. Elevation of the bottom of Layer 4 was verified against bedrock elevation information in the Geotechnical Analysis Report (GHD, 2012). The two elevation distributions were found to be similar but not identical. It was assumed that the elevation used in the model was based on more detailed and more recent information.
- Locations of general head boundaries, rivers, and seepage surface were verified against maps given in GHD (2012).
- Steady-state recharge distribution was inspected. Recharge was found to be within a possible range (maximum recharge is approximately 50% of the total precipitation during the observation period).
- Septic tank injection rates were also inspected to ensure that they were input correctly.

5.4 Hydraulic Conductivity

One of the key model parameters is hydraulic conductivity in the marine terrace aquifer. Data for the sandy material in the marine terrace indicate that hydraulic conductivity of the sandy material is on the order of 70 ft/day. However, the value is not based on direct measurements but rather on correlations between hydraulic conductivity and grain size distribution (GHD, 2012). The general hydraulic conductivity values used in the model to represent the marine terrace generally vary between 2 to 6 ft/day which is smaller than that based on grain size distribution. However, these values are within the range of hydraulic conductivity values in published literature (de Marsily, 1986). Many investigators including Eggleston and Rojstaczer (2001) found that measured hydraulic conductivity values could be much smaller than those determined based on grain size distributions. The model's hydraulic conductivity values of coastal bluffs and unconsolidated beach sands are 0.005 and 15 ft/day, respectively. These values are consistent with the published ranges for fine sands and sands, respectively (de Marsily, 1986).

5.5 Transient Simulations

The model was extended for transient applications. A specific yield value of 0.1 was assumed. This value is within a published range of specific yield values for fine sands and silts (Todd, 1976).

5.6 Quality of Simulation Results

MODFLOW-SURFACT generates quantitative information relating to the quality of the simulation results at the end of each simulation run. The final calibration run and the transient run had water balance errors of 0.06 and 0.01 percent, respectively. Simulation results are considered good when water balance errors are less than 1 percent.

6. SUMMARY AND RECOMMENDATIONS

6.1 Summary

The model for the City of Trinidad has been reviewed. The model was found to be consistent with the conceptual model outlined in GHD (2012). The model was verified against observed potentiometric elevation at nine observation wells. Material properties and recharge were found to be within reasonable ranges. Based on the data available, the model was found to be consistent with field observations.

The model developed based on a standard procedure. The model was calibrated with mean absolute error of 1.8 ft or 1.5 percent of the range of observed potentiometric elevation. The model is considered technically appropriate for applications in engineering design and evaluation.

6.2 Recommendations

The following are recommended:

- Sensitivity Analysis: Sensitivity analysis should be performed to quantify the model's predictive limits. At least two parameters, hydraulic conductivity and recharge should be included. Other possible parameters include: degree of hydraulic conductivity anisotropy, stream configuration and associated hydraulic properties, and boundary conditions.
- For transient model applications, the model should be used with caution as it has not been calibrated with transient data. Additional sensitivity analyses to bracket the range of storage parameter uncertainty should be performed.

7. REFERENCES

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Appendix E

CNDDB Search

Appendix E, California Natural Diversity Database Search

SciName	ComName	ElmCode	TotalOccs	FedList	CalList	GRank	SRank	RPlant Rank	OthrStatus	Habitats	GenHab	MicroHab	Return Occs
Arborimus albipes	white-footed vole	AMAFF23010	3	None	None	G3G4	S2S3		CDFW_SSC-Species of Special Concern | IUCN_LC-Least Concern	North coast coniferous forest | Redwood | Riparian forest	Mature coastal forests in Humboldt & Del Norte cos. Prefers areas near small, clear streams with dense alder & shrubs.	Occupies the habitat from the ground surface to the canopy. Feeds in all layers & nests on the ground under logs or	1
Lycopodiella inundata	inundated bog-clubmoss	PPLYC03060	3	None	None	G5	S1?	2B.2		Bog & fen | Lower montane coniferous forest | Marsh & swamp |	Bogs and fens, lower montane coniferous forest, marshes and	Peat bogs, muddy depressions, pond margins. 0-1000m.	1
Gilia capitata ssp. pacifica	Pacific gilia	PDPLM040B6	38	None	None	G5T3T4	S2.2?	1B.2		Coastal bluff scrub | Coastal prairie | Valley & foothill grassland	Coastal bluff scrub, coastal prairie, valley and foothill grassland.	5-300m.	1
Castilleja litoralis	Oregon coast paintbrush	PDSCR0D012	34	None	None	G4G5T4	S2.2	2B.2		Coastal bluff scrub | Coastal dunes | Coastal scrub	Coastal bluff scrub, coastal dunes, coastal scrub.	Sandy sites. 15-100 m.	7
Juncus	Sierra rush	PMJUN011Z5	1	None	None	G5T3T4	S1	2B.2		Bog & fen | Wetland	Bogs and fens.	0-10m.	1
Lathyrus palustris	marsh pea	PDFAB250P0	8	None	None	G5	S2S3	2B.2		Bog & fen | Coastal prairie | Coastal scrub | Lower montane coniferous forest | Marsh & swamp | North coast coniferous forest |	Bogs & fens, lower montane conif. forest, marshes & swamps, N. Coast coniferous forest, coastal prairie, coastal scrub.	Moist coastal areas. 1-100m.	1
Spirinchus thaleichthys	longfin smelt	AFCHB03010	11	None	Threatened	G5	S1		CDFW_SSC-Species of Special Concern	Aquatic | Estuary	Euryhaline, nektonic & anadromous. Found in open waters of estuaries, mostly in middle or bottom of water column.	Prefer salinities of 15-30 ppt, but can be found in completely freshwater to almost pure seawater.	1
Eucyclogobius newberryi	tidewater goby	AFCQN04010	117	Endangered	None	G3	S2S3		AFS_EN-Endangered | CDFW_SSC-Species of Special Concern | IUCN_VU-Vulnerable	Aquatic | Klamath/North coast flowing waters | Sacramento/San Joaquin flowing waters | South coast flowing	Brackish water habitats along the Calif coast from Agua Hedionda Lagoon, San Diego Co. to the mouth of the Smith	Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water & high	1
Trichodon cylindricus	cylindrical trichodon	NBMUS7N020	14	None	None	G4G5	S2	2B.2	USFS_S-Sensitive	Broadleaved upland forest | Upper montane coniferous forest	Broadleafed upland forest, upper montane coniferous forest.	Moss growing in openings on sandy or clay soils on roadsides, stream banks, trails or in	1
Ascaphus truei	Pacific tailed frog	AAABA01010	218	None	None	G4	S2S3		CDFW_SSC-Species of Special Concern | IUCN_LC-Least Concern	Aquatic | Klamath/North coast flowing waters | Lower montane coniferous forest | North coast coniferous forest | Redwood | Riparian forest	Occurs in montane hardwood-conifer, redwood, Douglas-fir & ponderosa pine habitats.	Restricted to perennial montane streams. Tadpoles require water below 15 degrees C.	3
Carex lenticularis var. limnophila	lagoon sedge	PMCYP037A7	4	None	None	G5T5	S1S2.2	2B.2		Bog & fen | Marsh & swamp | North coast coniferous forest	Bogs and fens, marshes and swamps, North Coast coniferous forest.	Lakeshores, beaches. 0-6m.	1

Discelium nudum	naked flag moss	NBMUS2E010	2	None	None	G3G4	S1	2B.2	USFS_S-Sensitive	Coastal bluff scrub	Coastal bluff scrub.	Moss that grows on moist silty to fine sandy banks of somewhat shaded sites. 5-1500m.	1
Lycopodium clavatum	running-pine	PPLYC01080	120	None	None	G5	S4.1	4.1		Marsh & swamp | North coast coniferous forest | Wetland	North Coast coniferous forest, marshes and swamps.	Forest understory; mesic sites with partial shade and light. 45-1640m.	5
Oceanodroma furcata	fork-tailed storm-petrel	ABNDC04010	8	None	None	G5	S1		BLM_S-Sensitive | CDFW_SSC-Species of Special Concern | IUCN_LC-Least Concern	Protected deepwater coastal communities	Colonial nester on small, offshore islets. Forages over the open ocean, usually well off-shore.	Birds choose off-shore islets which provide nesting crannies beneath rocks or sod for burrowing.	4
Oncorhynchus clarkii clarkii	coast cutthroat trout	AFCHA0208A	47	None	None	G4T4	S3		AFS_VU-Vulnerable | CDFW_SSC-Species of Special Concern | USFS_S-Sensitive	Aquatic | Klamath/North coast flowing waters	Small coastal streams from the Eel River to the Oregon border.	Small, low gradient coastal streams & estuaries. Need shaded streams with water temps <18C, & small gravel for spawning	6
Sphagnum Bog	Sphagnum Bog	CTT51110CA	12	None	None	G3	S1.2			Bog & fen | Wetland			1
Carex leptalea	bristle-stalked sedge	PMCYP037E0	9	None	None	G5	S2?	2B.2		Bog & fen | Freshwater marsh | Marsh & swamp | Meadow & seep | Wetland	Bogs and fens, meadows, marshes and swamps.	Mostly known from bogs and wet meadows. 0-790m.	3
Carex viridula ssp. viridula	green yellow sedge	PMCYP03EM5	7	None	None	G5T5	S2	2B.3		Bog & fen | Marsh & swamp | North coast coniferous forest | Wetland	Bogs and fens, marshes and swamps (freshwater), North Coast coniferous forest.	Mesic sites. 0-1600 m.	1
Cerorhinca monocerata	rhinoceros auklet	ABNNN11010	10	None	None	G5	S3		CDFW_WL-Watch List | IUCN_LC-Least Concern		Off-shore islands and rocks along the California coast.	Nests in a burrow on undisturbed, forested and unforested islands, and probably in cliff caves on the mainland.	1
Charadrius alexandrinus nivosus	western snowy plover	ABNNB03031	120	Threatened	None	G3T3	S2		ABC_WLBCC-Watch List of Birds of Conservation Concern | CDFW_SSC-Species of Special Concern | USFWS_BCC-Birds of Conservation Concern	Great Basin standing waters | Sand shore | Wetland	Sandy beaches, salt pond levees & shores of large alkali lakes.	Needs sandy, gravelly or friable soils for nesting.	1
Erigeron bloomeri var. nudatus	Waldo daisy	PDAST3M0M2	16	None	None	G5T4	S2?	2B.3		Lower montane coniferous forest | Ultramafic | Upper montane coniferous forest	Lower montane coniferous forest, upper montane coniferous forest.	In open areas on dry rocky outcrops on serpentine. 600-2300m.	1
Phalacrocorax auritus	double-crested cormorant	ABNFD01020	37	None	None	G5	S3		CDFW_WL-Watch List | IUCN_LC-Least Concern	Riparian forest | Riparian scrub | Riparian woodland	Colonial nester on coastal cliffs, offshore islands, & along lake margins in the interior of the state.	Nests along coast on sequestered islets, usually on ground with sloping surface, or in tall trees along lake margins.	3

Rhyacotriton variegatus	southern torrent salamander	AAAAJ01020	172	None	None	G3G4	S2S3		CDFW_SSC-Species of Special Concern | IUCN_LC-Least Concern | USFS_S-Sensitive	Lower montane coniferous forest | Oldgrowth | Redwood | Riparian forest	Coastal redwood, Douglas-fir, mixed conifer, montane riparian, and montane hardwood-conifer habitats. Old growth forest.	Cold, well-shaded, permanent streams and seepages, or within splash zone or on moss-covered rock within trickling water.	7
Sitka Spruce Forest	Sitka Spruce Forest	CTT82110CA	4	None	None	G1	S1.1						1
Arborimus pomo	Sonoma tree vole	AMAFF23030	214	None	None	G3	S3		CDFW_SSC-Species of Special Concern | IUCN_NT-Near Threatened	North coast coniferous forest | Oldgrowth | Redwood	North coast fog belt from Oregon border to Somona Co. In Douglas-fir, redwood & montane hardwood-conifer forests.	Feeds almost exclusively on Douglas-fir needles. Will occasionaly take needles of grand fir, hemlock or spruce.	1
Castilleja mendocinensis	Mendocino Coast paintbrush	PDSCR0D3N0	45	None	None	G2	S2.2	1B.2	BLM_S-Sensitive	Closed-cone coniferous forest | Coastal bluff scrub | Coastal dunes | Coastal prairie | Coastal scrub	Coastal bluff scrub, coastal scrub, coastal prairie, closed-cone coniferous forest, coastal dunes.	Often on sea bluffs or cliffs in coastal bluff scrub or prairie. 0-160m.	1
Empetrum nigrum	black crowberry	PDEMP03020	4	None	None	G5	S2?	2B.2		Coastal bluff scrub | Coastal prairie	Coastal bluff scrub, coastal prairie.	10-200m.	1
Fratercula cirrhata	tufted puffin	ABNNN12010	17	None	None	G5	S2		CDFW_SSC-Species of Special Concern | IUCN_LC-Least Concern	Protected deepwater coastal communities	Open-ocean bird; nests along the coast on islands, islets, or (rarely) mainland cliffs.	Requires sod or earth into which the birds can burrow, on island cliffs or grassy island slopes.	5
Rana aurora	northern red-legged frog	AAABH01021	91	None	None	G4T4	S2?		CDFW_SSC-Species of Special Concern | USFS_S-Sensitive	Klamath/North coast flowing waters | Riparian forest | Riparian woodland	Humid forests, woodlands, grasslands, & streamsides in northwestern California, usually near dense riparian cover.	Generally near permanent water, but can be found far from water, in damp woods and meadows, during non-breeding season.	2
Romanzoffia tracyi	Tracy's romanzoffia	PDHYD0E030	9	None	None	G4	S2	2B.3		Coastal bluff scrub | Coastal scrub	Coastal bluff scrub, coastal scrub.	Rocky sites. 15-300 m.	5
Polemonium carneum	Oregon polemonium	PDPLM0E050	16	None	None	G4	S1	2B.2		Coastal prairie | Coastal scrub | Lower montane coniferous forest	Coastal prairie, coastal scrub, lower montane coniferous forest.	0-1830m.	1
Viola palustris	alpine marsh violet	PDVIO041G0	10	None	None	G5	S1S2	2B.2		Bog & fen | Coastal scrub | Wetland	Coastal scrub, bogs and fens.	Swampy, shrubby places in coastal scrub or coastal bogs. 0-15m.	1

Appendix F

USFWS Search

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Listed/Proposed Threatened and Endangered Species for the TRINIDAD Quad (Candidates Included)

August 6, 2013

Document number: 108601033-95411

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KEY:

(PE) Proposed Endangered Proposed in the Federal Register as being in danger of extinction
(PT) Proposed Threatened Proposed as likely to become endangered within the foreseeable future
(E) Endangered Listed in the Federal Register as being in danger of extinction
(T) Threatened Listed as likely to become endangered within the foreseeable future
(C) Candidate Candidate which may become a proposed species Habitat Y = Designated, P = Proposed, N = None Designated
* Denotes a species Listed by the National Marine Fisheries Service

Type		Scientific Name	Common Name	Category	Critical Habitat
Invertebrates					
	*	*Haliotis cracherodii*	black abalone	E	N
Fish					
	*	*Acipenser medirostris*	green sturgeon	T	Y
		Eucyclogobius newberryi	tidewater goby	E	Y
	*	*Oncorhynchus kisutch*	S. OR/N. CA coho salmon	T	Y
	*	*Oncorhynchus mykiss*	Northern California steelhead	T	Y
	*	*Oncorhynchus tshawytscha*	CA coastal chinook salmon	T	Y
	*	*Thaleichthys pacificus*	Southern eulachon DPS	T	Y
Reptiles					
	*	*Caretta caretta*	loggerhead turtle	T	N
	*	*Chelonia mydas (incl. agassizi)*	green turtle	T	N
	*	*Dermochelys coriacea*	leatherback turtle	E	Y
	*	*Lepidochelys olivacea*	olive (=Pacific) ridley sea turtle	T	N
Birds					
		Brachyramphus marmoratus	marbled murrelet	T	Y
		Charadrius alexandrinus nivosus	western snowy plover	T	Y
		Coccyzus americanus	Western yellow-billed cuckoo	C	N
		Phoebastris albatrus	short-tailed albatross	E	N
		Strix occidentalis caurina	northern spotted owl	T	Y
		Synthliboramphus hypoleucus	Xantus's murrelet	C	N
Mammals					
	*	*Balaenoptera borealis*	sei whale	E	N
	*	*Balaenoptera musculus*	blue whale	E	N
	*	*Balaenoptera physalus*	fin whale	E	N
	*	*Eumetopias jubatus*	Steller (=northern) sea-lion	T	Y
	*	*Megaptera novaengliae*	humpback whale	E	N
	*	*Orcinus orca*	killer whale, S. resident	E	Y
	*	*Physeter macrocephalus*	sperm whale	E	N

Appendix G

City of Trinidad ASBS Stormwater Geotechnical Analysis Report

City of Trinidad ASBS Stormwater Geotechnical Analysis Report- FINAL DRAFT

October 2012

Paid for with funds from:
Proposition 84 (State Water Resources Control Board Agreement No. 10-427-550)

CITY OF TRINIDAD ASBS STORMWATER GEOTECHNICAL ANALYSIS REPORT
FINAL DRAFT
TRINIDAD, CALIFORNIA

Project No. 0106311005

Prepared for:
City of Trinidad
409 Trinity Street
Trinidad, California 95570

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October 12, 2012

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1.0 EXECUTIVE SUMMARY

The City of Trinidad (the City) is undertaking a project to make changes to the City stormwater drainage system. The City's existing stormwater system, initially constructed in the early 1970's, discharges to a single 32-inch stormwater outfall, which discharges to Trinidad Bay, designated as an Area of Special Biological Significance (ASBS). This area was designated as an ASBS because of the fluctuating presence of bull kelp (*Nereocystis luetleana*), which are considered biologically significant in providing an ecological base for fish and invertebrate habitats by supplying food and shelter. Bull kelp may be adversely affected by contaminated stormwater discharges, which could damage the dependent ecosystem it supports.

The objective of the City's stormwater system project is to capture and treat stormwater runoff from rainfall events by redirecting the runoff into underground infiltration galleries constructed in multiple locations within the City. Some treatment and infiltration will also be accomplished through the construction of other Best Management Practices (BMPs) and Low Impact Development (LID) technologies in strategic locations. The project will benefit the ASBS immediately by eliminating an estimated 22 to 40 percent of the City's stormwater that is currently discharged to the ASBS through the 32-inch "high threat discharge" outfall (TRI032), significantly reducing pollutant loading and helping to protect water quality and beneficial uses.

This report presents an evaluation of the geologic conditions within the project area. The geotechnical investigation included subsurface exploration and geophysical field studies within the project area for the development of a site conceptual model. Evaluation of the data collected during this geotechnical investigation has led to the following conclusions and recommendations for the stormwater system design:

- The marine terrace formation underlying the majority of the project area is dominated by fine to medium-grained beach sand, up to 70 feet thick, with local discontinuous thin layers of silt and gravel generally less than 2 feet thick.
- The bedrock surface encountered underlying the marine terraces is considered to be a larger block of competent Franciscan mélange material ranging from 15 to 70 feet below the surface. Higher elevation bedrock surfaces are indicated by a horseshoe shaped ridge sloping from the north to south around the northern

project area, and a north-south trending narrow ridge between Ocean Avenue and Trinity Street ending at the cliffs near Edwards Street. Corresponding bedrock lows occur as north-south trending troughs below the southern half of Ocean Avenue and Trinity Street.

- Below the project area groundwater flow direction and gradient is thought here to be controlled by the shape and slope of the bedrock surface: flowing along the bedrock ridges to the troughs and out the bedrock/marine terrace interface at the exposed cliffs to the northwest and south, and to fluvial systems to the north (Mill Creek) and east (Park Creek). Generally, the groundwater flow paths radially extend away in all directions from a point in the northern segment of Trinity Street with the bulk of aquifer collecting and flowing south within the two north-south trending troughs. The fact that ground water levels don't fluctuate significantly is an indication that groundwater is being recharged/mounded from inputs (septic systems, leaking water lines, irrigation, etc.) other than rainfall alone.
- The estimated saturated hydraulic conductivity of the marine terrace, calculated from the particle size distribution of the sieved samples collected from borings, ranged from approximately 15.4 to 23.3 meters per day.

2.0 INTRODUCTION

2.1 Project Area

This project area encompasses two (2) watersheds: the Mill Creek and City of Trinidad watersheds (see Figure 1, Appendix A). The Mill Creek watershed is bisected by Highway 101 but otherwise is primarily forested with minimal development. Currently, stormwater that accumulates in the northern portions of town drain into Mill Creek, which discharges near Trinidad State Beach approximately 500 feet north of the ASBS. Approximately 20% of the City's stormwater currently drains to Mill Creek. The City of Trinidad watershed encompasses most of the City, the surrounding coastal bluffs, and Trinidad Head. The City's stormwater system collects much of the stormwater that accumulates within the City of Trinidad and discharges it directly to the ASBS through discharge TRI032 (Shown in Figure 1, Appendix A). Approximately 80% of the City's stormwater currently drains to this outfall.

2.2 Objectives

The long term goal of the City is to eliminate polluted stormwater discharge from the City to the ASBS for storms up to the 100-year event. Stormwater runoff will be reduced through the implementation of LID and BMPs installed throughout the City. The use of LID techniques to retain, treat, and infiltrate stormwater is an effective means to meet stormwater quantity and quality goals as well as being aesthetically pleasing and environmentally sound.

The project is being under taken in two (2) phases. The first phase will address the upper area, occupied by the majority of the City, and the second phase will address the lower area on the southwestern edge of the City. While the final design and construction of the project will be undertaken in two (2) phases, this geotechnical report and subsequent infiltration modeling (based in part on this geotechnical report) which will evaluate the entire project area, as discussed more below.

This geotechnical evaluation was completed to determine existing groundwater flow patterns and physical properties of the aquifer to understand subsurface conditions so that stormwater can be effectively treated without negatively affecting the function of the numerous existing on-site wastewater treatment systems (OWTS/septic systems) or impacting coastal bluff stability. Parameters which have a direct impact on design of stormwater infiltration include: groundwater flow regime, topography, aquifer thickness, soil type, unsaturated soil thickness, existing groundwater mounding, permeability, inter-bedding of marine terrace materials, and the presence/location of bedrock. Data collected during this geotechnical investigation will be used in design and implementation (construction) of the BMP/LID technologies.

The goals of the geotechnical investigation described in this report are as follows:

1. Characterize the subsurface system including stratigraphy and depth to bedrock
2. Characterize groundwater depth, gradient, and flow direction
3. Develop a site conceptual model of the subsurface system

2.3 Geologic Setting

The Franciscan Complex, a late Mesozoic complex of subducted rocks composed of highly sheared oceanic sediments that were deformed above the oceanic plate (which is sliding underneath western North America) comprises the bedrock underlying the project area (Aalto, 1982). These Franciscan rocks comprise the competent rocks of resistant headlands and sea stacks along the Trinidad coast and consist of greywacke, sandstone, marine sandstones, biogenic ribbon chert, limestone, greenstone, ultramafic and mafic plutonic rocks, and bluechist-facies metamorphic rocks (Aalto, 1976). The lesser constituents exist as blocks, or mixtures of blocks, ranging on a scale from centimeters to kilometers in length along the northern California within mélange units. The mixtures of blocks comprising mélanges exist in a highly sheared shale and/ or serpentinite matrix often described as ‘plum pudding’ or ‘blue goo’ (Aalto, 2009).

The Franciscan Formation is unconformably overlain by Pleistocene marine terraces along the Trinidad coast, within the project area, and up to several miles inland. The presence of stair-stepping, progressively older (and higher in elevation) marine terraces inland is a result of the ongoing deformation of the northern California coast along thrust faults, which account for most of the uplift. In the project area, a series of three (3) terraces were previously mapped as follows: (Rust, 1982, Stephens, 1982); Trinidad Low marine terrace (Qtmtl, approximately 40,000 years old), located closest to Trinidad Head, the Luffenholtz marine terrace (Qtml, approximately 60,000 years old) and the Patrick's Point terrace (Qtmpp, approximately 83,000 years old). According to the map produced by Rust (1982), the City was built on the Patrick's Point Terrace (Qtmpp). Additionally, the Trinidad Low marine terrace and/or the Luffenholtz marine terrace (Qtml) unconformably overlies an older (approximately 370 years old) marine terrace, marked with a paleosol (buried soil) at the contact (Stephens, 1982, Rust, 1982). These marine terraces can be generally described as thin to massive intervals of fine to coarse beach sands (mixed with various quantities of silt) containing local stringers of beach and fluvial gravels.

The project area is complicated by ongoing faulting of the Franciscan Complex rocks and the younger overlying marine terrace sediments. The close proximity of the offshore Cascadia Subduction Zone has resulted in crustal shortening and onshore tectonic deformation. At least two (2) faults exist within the project area and have been mapped and trenched for paleoseismic information; the Anderson Ranch (also called the Trinidad Fault) and the Trinidad Head Fault. The Anderson Ranch fault is located at the eastern boundary of the project area. The rise in land north of the Chevron Station (at the intersection of Scenic Drive and Main Street) is the fault line scarp of the Anderson Ranch Fault. The Trinidad Head Fault is northwest/southeast trending and mapped in the low elevation notch between Trinidad Head and the slope that rises toward Trinidad along Pier Street. According to Rust (1982), the Trinidad Head fault is interpreted as northeast-dipping. However, later interpretation by K.R. Aalto (2009), observed this fault to be a southwest-dipping normal fault.

Additionally, mass movements including but not limited to debris flows, hillslope creep, and slumps, commonly occur along the coast north and south of the project area where more competent mélange blocks are relatively small and the surrounding matrix materials are dominant. The majority of the coast north of Trinidad to Patrick's Point and south to Moonstone Beach have been found to be extremely susceptible to small and large scale erosion (Aalto, 1977, Aalto, 2009, Rust, 1982) within the less competent mélange matrix. Identification of the general type and condition of the underlying Franciscan Complex mélange is critical to planning and engineering on the northern Californian coastline. However, as seen in Trinidad, the marine terrace margin is generally found to be more stable when overlying massive beachfront sandstone and greenstone units that buffer the high energy ocean waves. Nestled between these competent rocks that form much of the seastacks and headlands, are sandy coves and beaches.

3.0 Field Activities

Prior to conducting field work approvals were obtained and preliminary reconnaissance of the project area was conducted. A drilling permit was obtained from the Humboldt County Department of Environmental Health (HCDEH), a copy of which is included in Appendix B. The proposed location of each boring was marked with white paint and Underground Service Alert was notified at least 48 hours prior to subsurface investigation to mark the locations of subsurface utilities. The HCDEH and the City of Trinidad were notified in advance of scheduled drilling and sampling activities and information on the subsurface investigation was made available to the public.

3.1 Soil Borings

In January and February 2012, GHD oversaw Clear Heart Drilling Inc. of Santa Rosa, California, during the drilling of 18 soil borings (SB-1 through SB-18). The borings were drilled using a truck-mounted drill rig fitted with 8-inch diameter hollow stem augers. Each location was hand augered prior to drilling to a depth of approximately five (5) feet below ground surface (bgs). The soil borings (SB-1 through SB-18) were drilled to varying total depths based on the location of the bedrock surface.

Each boring was observed by Ruby Rollins, a cultural monitor with Trinidad Rancheria's Tribal Historic Preservation Office. Ms. Rollins did not note any items of cultural or historical significance with the soil cuttings of the borings. The location of the soil borings is shown on Figure 2 (Appendix A). Boring logs are included in Appendix C.

Soil samples were collected using a either a two (2)-inch split-spoon sampler continuously, or at 5-foot intervals. The soil profile was classified and entered on a field boring log using the American Society for Testing and Materials, (ASTM *Visual Manual Procedure* D 2488-09a) and Munsell Soil Color Charts. Observations on lithology, moisture, consistency/density, plasticity, first encountered groundwater estimates, oxidation and mottling, and sample depths were noted on the boring logs as appropriate. Representative samples of the subsurface materials were retained and labeled for sieve analysis and stratigraphic reference from each boring location. Table 1 (below) presents the boring location and total depth of exploration for each borehole.

Table 1. Total Completed Depth Soil Boings SB-1 through SB-18

Boring	Completed Depth (feet bgs)
SB-1	39
SB-2	34
SB-3	43
SB-4	55
SB-5	58
SB-6	60
SB-7	66.5
SB-8	50.5
SB-9	40.5
SB-10	43.5
SB-11	63
SB-12	61.5
SB-13	39.5
SB-14	22
SB-15	23
SB-16	29
SB-17	51.5
SB-18	70

bgs- below ground surface

3.2 Monitoring Well Installation

Nine (9) groundwater monitoring wells (MW-1 through MW-9) were installed throughout the project area using existing borings drilled during this investigation. The locations of the monitoring wells are identified on Figure A-2 (Appendix A). Table 2 (below) identifies the soil boring locations which were converted into the nine (9) monitoring wells installed.

Table 2. Soil Borings Completed as Monitoring Wells

Soil Boring	Corresponding Monitoring Well	Total Depth (ft-bgs)	TOC Elevation (msl)	Screened Interval (bgs)
SB-16	MW-1	29	28.26	19-29
SB-13	MW-2	39	93.46	29-39
SB-17	MW-3	51.5	118.99	41.5-51.5
SB-1	MW-4	39	170.98	29-39
SB-10	MW-5	43	171.62	33-43
SB-2	MW-6	34	152.73	24-34
SB-4	MW-7	55	175.33	45-55
SB-8	MW-8	49	176.72	29-49
SB-18	MW-9	70	174.23	50-70

TOC- Top of casing
bgs- below ground surface

3.2.1 Monitoring Well Construction

Monitoring wells MW-1 through MW-9 were constructed of two-inch diameter blank polyvinyl chloride (PVC) well casing from the surface down to the slotted screen intervals. The factory-slotted well screens (0.010-inch) were placed at ten (10) to 20 foot intervals and depth to the top of the screens ranges from approximately 19 feet to 50 feet bgs in the monitoring wells. A uniform filter pack of Cemex #2/12 washed silica sand was placed around the well casings from a minimum of two (2) feet above the slotted screens to the bottom of the wells. A two(2)-foot thick seal of hydrated bentonite pellets was placed over the filter pack, then a surface/sanitary seal of cement was placed to within one (1) foot of the surface and finished with one foot of concrete. The top of each well casing was cut at approximately two (2)-inches below the well vault grade.

The new monitoring wells are protected by flush-mounted traffic rated boxes set in concrete, expandable well plugs, and a locked cap. The top of the traffic boxes are set slightly above the adjacent surface grade with a gently sloping concrete rim to avoid ponding water during the winter months. The horizontal location and top-of-casing (TOC) elevation of each new monitoring well were surveyed as described in Section 3.2.2 of this report. Monitoring well construction logs are included in Appendix D.

3.2.2 Field Survey

Horizontal well locations and TOC elevations were surveyed on March 23, 2012, by Phil Guttierez, a licensed surveyor, to facilitate calculations for groundwater flow direction and gradient. TOC elevations were surveyed to the nearest 0.01 foot above mean seal level (msl) relative to the North American Vertical Datum of 1988 (NAVD88). Horizontal well locations were surveyed relative to State Plane Coordinate System and in degrees latitude/longitude to seven (7) decimal places relative to the North American Datum of 1983 (NAD83).

3.2.3 Groundwater Elevation Gauging

The depth-to-groundwater (DTW) was measured in each of the nine (9) monitoring wells (MW-1 through MW-9) on March 12, 2012, April 2, 2012, June 28, 2012 and September 20, 2012 per GHD standard operating procedures (SOPs). GHD SOPs are included as Appendix E. The final DTW measurement at each monitoring well was recorded after groundwater levels had equilibrated to atmospheric pressure for at least 15 minutes. Measurements were obtained using an electronic water level meter. DTW measurements for the four (4) gauging events are presented on Table 3, below. DTW measurement field forms are included as Appendix F.

Table 3. Groundwater Monitoring Data

Well	Date	Groundwater Elevation (ft MSL)	Top of Casing (ft MSL)	Depth to Water (ft below TOC)
MW-1	3/12/12	11.27	28.26	16.99
	4/2/12	13.84	28.26	14.42
	6/28/12	10.52	28.26	17.74
	9/20/12	8.74	28.26	19.52
MW-2	3/12/12	64.11	93.46	29.35
	4/2/12	65.60	93.46	27.86
	6/28/12	66.13	93.46	27.33
	9/20/12	63.40	93.46	30.06
MW-3	3/12/12	78.37	118.99	40.62
	4/2/12	79.98	118.99	39.01
	6/28/12	78.48	118.99	40.51
	9/20/12	76.11	118.99	42.88
MW-4	3/12/12	136.38	170.98	34.60
	4/2/12	137.16	170.98	33.82
	6/28/12	136.10	170.98	34.88
	9/20/12	134.54	170.98	36.44
MW-5	3/12/12	133.40	171.62	38.22
	4/2/12	133.93	171.62	37.69
	6/28/12	134.62	171.62	37.00
	9/20/12	132.51	171.62	39.11
MW-6	3/12/12	134.48	152.73	18.25
	4/2/12	136.38	152.73	16.35
	6/28/12	135.83	152.73	16.90
	9/20/12	134.04	152.73	18.69
MW-7	3/12/12	134.98	175.33	40.35
	4/2/12	135.42	175.33	39.91
	6/28/12	137.57	175.33	37.76
	9/20/12	135.82	175.33	39.51
MW-8	3/12/12	132.51	176.72	44.21
	4/2/12	133.04	176.72	43.68

Well	Date	Groundwater Elevation (ft MSL)	Top of Casing (ft MSL)	Depth to Water (ft below TOC)
	6/28/12	134.91	176.72	41.81
	9/20/12	143.52	176.72	33.20
MW-9	3/12/12	120.35	174.23	53.88
	4/2/12	118.10	174.23	56.13
	6/28/12	118.68	174.23	55.55
	9/20/12	117.71	174.23	56.52

ft MSL = feet relative to mean sea level
ft TOC = feet below top of casing
ft bgs = feet below ground surface
NA = information not available

3.3 Bedrock and Seep/Spring Mapping

On January 25, 2012, GHD's project geologist conducted a preliminary seep/spring and bedrock mapping survey of the cliffs, bluffs, gulleys, and slopes to the north, west, and south of the project area (See Figures A-3 and A-4, Appendix A) for locations of seeps, springs, and bedrock observations). These portions of the project area were transversed throughout for evidence of bedrock and hydrological indicators. Identified locations were approximately placed on high resolution satellite imagery and compared with historical mapping (Rust, 1982).

Seeps and springs were generally observed to be daylighting at the bedrock/marine terrace interface on the exposed cliffs, bluffs, gulleys, and slopes to the north, west, and south of the project area. Therefore, the bedrock and seep/spring observations (See Figure A-4) were used in conjunction with the depth to bedrock observations in borings and geophysical data (See Figure A-3 for seismic refraction and electric resistivity profile locations and boring locations) in the north, west, south, southwest, and east of project area in order to estimate bedrock elevations in the remaining areas where bedrock could not be physically observed.

Additionally, a portion of the southern cliff areas contain terraces historically occupied and utilized by the Tsurai People, and is therefore culturally sensitive. For this reason, the portion of field mapping within the traditional lands of the Tsurai in the southern portion of the project area, was conducted with Joe Lundgren of the Tsurai Ancestral Society. Mr. Lundgren provided key current and historical information on seep and spring locations.

4.0 RESULTS

4.1 Summary of Subsurface Data

4.1.1 Stratigraphy

The marine terrace stratigraphy described herein is taken from the descriptions on project area boring logs obtained during this study (SB-1 through SB-18). Boring and trench logs from previous consultants (Busch Geotechnical Consultants [BGC], LACO, Taber Consultants [Taber], California Department of Transportation [Caltrans], GHD, and Oscar Larson Associates [OLA]) were also reviewed and discussed via personal communication (BCG, 2012).

Stratigraphy of the upper five (5) feet to the surface in the project area has been described from boring logs (using the ASTM D2488-09a) as loose to compact disturbed and mixed fill materials of imported river gravel, sand, and silt. Where undisturbed, the upper five (5) feet is generally loose to compact organic-rich silt, silt with fine sand, or fine sandy silt (SM).

Underlying the upper sandy silt layer, the majority of the subsurface materials encountered were generally dominated by loose, poorly graded, fine and medium-grained sand (SP) down to bedrock (up to 70' thick, see Table C below). Lesser quantities of coarse grained sand were observed within well graded sand (SW) packages and intervals ranging from approximately one (1) foot to 20 feet thick. The SW units were found overlying bedrock in 14 of the 18 borings, and often contained highly oxidized fines (silt and clay) and precipitates on grains. A few thin (approximately one half [0.5] foot to two [2] feet thick) intervals of well graded and well-rounded gravel were encountered within borings ranging from approximately13 feet to 20 feet bgs and generally bound above, and below, by poorly graded sand.

However, sieve results (Appendix H, and further discussed in section 4.1.3 below) of well graded sand (SW) sand samples indicate many of those units are dominated by sand grains of a diameter less than 0.5 millimeters (fine to medium grained sand). Additionally, stratigraphic units described as silty sand (SM), after sieving were also found to be generally dominated by fine sand. Therefore, as discussed further in Section 6.0 (Summary and Conclusions), the groundwater hydrology of the project area subsurface should be modeled to reflect unconsolidated marine sand (fine to medium-grain size) with relatively high porosity (approximately 30 to 35%).

4.1.2 Bedrock Surface

Franciscan Bedrock was encountered in borings SB-1 through SB-18. Each boring was generally terminated within a foot or less into bedrock surface. Where possible, a bedrock sample was collected from the cutting shoe of the soil sampler. In some borings, approximately one (1) to two (2) feet of weathered bedrock was encountered above the competent bedrock surface. Table 4 (below) identifies the depth to competent bedrock observed at each boring location. Figures A-3 and A-4 (Appendix A) present observations of bedrock outcrops and depth to bedrock encountering during subsurface investigation within the project area.

The field geologist generally identified the type of bedrock encountered, all of which is interpreted as the Franciscan Complex mélange marine sandstone and shale rocks previously mapped/identified by Aalto and others in the project area. These rocks ranged from having no obvious deformation to highly sheared. Laboratory analysis was not completed on the bedrock samples to determine the degree of competency or shear strength properties.

Table 4. Depth to Bedrock- Soil Borings SB-1 through SB-18

Soil Boring Location	Depth to Bedrock (feet bgs)	Bedrock Type
SB-1	39	Siltstone
SB-2	34	Siltstone
SB-3	43	Graywacke/Sandstone
SB-4	55	Graywacke
SB-5	58	Sandstone
SB-6	60	Highly Sheared Siltstone
SB-7	66.5	Hard Siltstone
SB-8	50	Mudstone
SB-9	40.5	Siltstone
SB-10	43.5	Sandstone/Graywacke
SB-11	63	Sandstone
SB-12	61.5	Sandstone
SB-13	39.5	Highly Sheared Siltstone
SB-14	22	Highly Sheared Siltstone
SB-15	23	Sandstone
SB-16	29	Sandstone
SB-17	51.5	Siltstone
SB-18	70	Sandstone

4.1.3 Sieve Methods, Analysis, and Results

A mechanical sieve analysis was performed on 18 representative samples collected from the borings in the project area using the ASTM *Standard Test Method for Particle-Size Analysis of Soils* (ASTM D422-63[2007]). Since sand is the dominant material underlying the project area above bedrock, samples described in the field as poorly graded sand, well graded sand, and silty sand, were chosen to be sieved. Six (6) sieve sizes (Numbers 10, 16, 30, 50, 100, and 200) were used to separate the various particle sizes. Further separation of particle size (through sedimentation processes) was not completed on the material which passed the Number 200 sieve, as such the materials that passed through the smallest sieve (number 200) were assumed to be variable amounts of silt and clay. Material retained on the largest sieve (number 10) was identified as coarse sand.

Hydraulic conductivity is an important parameter in predicting water movement through porous media like the marine terrace formations found on the northern California coast. Saturated hydraulic conductivity (K_s, the ability of a fully water saturated porous material to transmit water though its pore spaces) can be estimated from particle size distribution (PSD) of the marine terrace materials. Investigators from 1892 (Hazen) to the present (Freeze and Cherry (1979), Shepard (1989), Alyamani and Sen (1993), and Salarashayeri, et. al. (2012), have related and reasonably estimated hydraulic conductivity to PSD. Using the distribution expressions d_{10}, d_{50}, and d_{60} (where 10%, 50%, and 60%, respectively, of the sample's mass is smaller than the corresponding diameter), K_s can be expressed in meters per day. Equations for K_s have been generated using d_{10} (Hazen 1892), and extended with power regression analysis (Shepard, 1989), and from multiple linear regressions (also using d_{50} and d_{60}) and statistically compared to observed vs. predicted values of K_s of sand (Salarashayeri, et. al., 2012). Studies have shown (Hazen, 1892, Alyamani and Sen, 1993, and Salarashayeri, et. al., 2012) that the relatively finer zone of PSD (d_{10}) plays a more significant role in estimating/calculating K_s using PSD data. For the purposes of this investigation, ten (10) equations were identified to calculate K_s, from Salarashayeri, et. al., to establish a range of potential values and identify the best model's value. The equation $K_s = 10.06+118.54*(d_{10})-12.5*(d_{50})-7.32*(d_{60})$ is identified by Salarashayeri, et. al. (2012) as the best model used to estimate K_s. By utilizing the mean d_{10}, d_{50}, and d_{60} of the samples collected as the effective parameters, this investigation calculated the K_s value for the marine terrace formations in the project area.

Fine and medium-grained sand were the bulk of the materials retained in the test samples sieved. The mean d_{10}, d_{50}, d_{60} values for each soil unit (SP, SW, and SM) sieved samples were used to calculate K_s. The range and best K_s values for each sample are shown in Table 5 (below) and in Appendix H. The range of the calculated K_s values for the project area marine terrace samples, 15.4 to 23.3 m/day, were found to be similar to that of other investigators calculations (Alyamani and Sen, 1993), and will be used for the project area model calibration.

TABLE 5: Particle Size Distribution and Estimated Hydraulic Conductivity

			Particle Size (µm) & Soil Type[1]									K_s (m/day)[2]		
Soil Unit	**Soil Boring**	**Sample Depth (ft bgs)**	**D10**	**Avg D10**	**D10 Soil Type**	**D50**	**Avg D50**	**D50 Soil Type**	**D60**	**Avg D60**	**D60 Soil Type**	**Min**	**Max**	**Recommended****
ML	SB-5	30	43	43		150	150		182	182				
SM	SB-8	4	162	155	Fine Sand	253	301	Fine Sand	275	349	Fine Sand	17.8	22.3	22.2
SM	SB-12	5	150			279			330					
SM	SB-15	6	152			262			290					
SM	SB-17	30-32	161			464			577					
SM	SB-18	10-12	151			249			274					
SP	SB-3	20-22	139	106	Fine Sand	239	193	Fine Sand	262	228	Fine Sand	15.4	21.1	18.6
SP	SB-8	35	128			229			250					
SP	SB-10	26	80			155			185					
SP	SB-13	20-22	78			150			215					
SW	SB-1	35-37	179	168	Fine Sand	912	609	Medium Sand	1084	737	Medium Sand	16.6	23.3	17.0
SW	SB-2	25	189			823			924					
SW	SB-4	45-47	121			276			368					
SW	SB-5	55-57	270			864			959					
SW	SB-6	50-52	131			272			330					
SW	SB-11	60-62	158			643			890					
SW	SB-16	20-22	130			328			394					
SW	SB-18	60-61	166			755			949					

[1] United States Department of Agriculture (USDA) Particle Size Separation
[2] K_s estimated using Equations 7 thru 16 from A.F. Salarashayeri and M. Siosemarde (2012). Recommended Ks based on Equation 16**(reported as best model for predicting K_s)

**EQUATION-16: K_s=10.06+118.54*(D_{10})-12.5*(D_{50})-7.32*(D_{60})

4.1.4 Hydrologic Units

This section summarizes the key findings of the Hydrologic unit findings.

- Upper 5 feet of fill and silt
- Majority of formation up to 70' thick fine to med-grained sand (SP and SW)
- Some thin (up to ~2' thick silt packages
- Bedrock assumed here to be relatively impermeable

4.1.5 Groundwater Seeps

Where encountered, seeps and spring systems were generally found to be at the bedrock/marine terrace contacts in the north, west, and south slopes surrounding the project area. Therefore, the seeps and springs were in some cases, used as an indicator marker of the bedrock/marine terrace interface at locations where the interface was not physically observed (covered in landslide materials, debris, etc.).

In general, seeps, or clusters of seeps, were more prevalent on the low point of bedrock cliff slopes containing paleochannels, pervasive jointing, and sheared bedrock, and areas of with marine terrace slope failures. Qualitatively, the seeps ranged from just a trickle of water flow (less than approximately 1/4 gallon per minute) around the north and west boundaries of the project area, to that of an open garden hose (greater than approximately 5 gallons per minute) on the southern boundary on the cliffs below Trinity Street, Ocean Avenue, and Wagner Street in the vicinity of the Tsurai village site (Figure A-3, Appendix A shows approximate seep locations).

4.1.6 Septic Inputs

An important component to understanding the subsurface system is the influence of septic systems on groundwater flow. All properties within the City discharge wastewater to individual septic systems. Groundwater flow into the subsurface system below the City is limited by capacity of the upper watershed to infiltrate water and carry it in the groundwater and the two (2) creeks (to the north and south) which direct groundwater away from the City. Thus, it is believed that flow from septic discharge constitutes a significant portion of the groundwater flow, especially during the summer months, and should be accurately included in the groundwater model.

The volume of water introduced into the subsurface is referred to as the septic loading rate. The septic loading rate will be developed based on water use records for a one (1) year period (September 2011 thru August 2012). A generalized loading rate for all residential properties will be developed. This generalized residential loading rate removes the variability due to changes in residential occupancy. Larger businesses will be modeled using actual water use data. For modeling purposes the water use will be modified to account for household consumptive use and outdoor irrigation. The final methodology will be included in the modeling report. Based on a preliminary analysis of water use it is estimated that total septic loading from all systems to the project area is between 19,000 gallons to 25,000 gallons per day.

4.1.7 Groundwater Gradient and Flow Direction

Using simple multi-linear regressions, groundwater flow directions and gradient were calculated using the monitoring wells MW-1 through MW-9. An overall flow direction was calculated using the nine (9) wells. However, due to the site vertical boundary conditions (topographic differences of the marine terrace and the vertical geometry of the monitoring wells relative to each other and variable bedrock elevations), and the various lateral boundary conditions to the north (Mill Creek), east (Parker Creek), south (cliffs and beach), and west (cliffs and beach), groups of three (3) and four (4) nearest neighbor monitoring wells were used to estimate groundwater gradient and flow direction within each of those locales (cells). Individual cells and groundwater flow direction for March 2012 and September 2012 are presented on Figures A-5 and A-6 (Appendix A), respectively.

From groundwater elevations collected in the March (See Figure A-5), April, and June of 2012, groundwater below the northern half of the City generally flows (inferred in the northwest portion from subsurface topography) to the north-northwest towards Parker Creek at a calculated hydraulic gradient up to 0.012 feet per foot (ft/ft). Below the southern half of the City, groundwater generally flows to the south and southwest with a hydraulic gradient up to 0.145 ft/ft. In the western portion of the City, groundwater flows to the west-southwest at a gradient up to 0.093 ft/ft.

Groundwater flow directions and gradient did not significantly change from the Winter/Spring conditions. Groundwater elevations collected in the September 2012 (See Figure A-6), indicated that groundwater below the northern half of the City generally flows (inferred in the northwest portion from subsurface topography) to the north-northwest towards Parker Creek at a calculated hydraulic gradient up to 0.012 feet per foot (ft/ft). Below the southern half of the City groundwater generally flows to the south and southwest with a hydraulic gradient up to 0.145 ft/ft. The western portion of the City groundwater flows to the west-southwest at a gradient up to 0.093 ft/ft.

4.2 Geophysics

Spectrum Geophysics conducted a geophysical investigation from August 8 to August 17, 2012 in the project area to further define the subsurface for input into the site conceptual model and eventually the groundwater model. Geophysical methods were used for the purpose of delineating detailed geologic stratigraphy and structure and to augment existing boring and well information within the project area. During this investigation, four (4) linear transects were established, and both seismic reflection and electrical resistivity data were collected along each transect. A discussion of the methods, field procedures, and data processing is presented in the full geophysics report included as Appendix G.

4.2.1 Geophysical Data

4.2.1.1 Electrical Resistivity

The final model section for a given transect (the image in the resistivity profiles) contains the inverted resistivity distribution which best represents the actual lateral and vertical variation of earth resistivity beneath the ground surface along that transect. It is from the model sections that inferences were made regarding depth to bedrock, structural features, and interpreted seastacks. Each transect had at least one (1) tie point where borings or monitoring wells intersected it. Careful review of the boring logs for these tie points was completed to allow correlation of resistivity values with known lithology.

During generation of the best-fit model resistivity section, the EarthImager2D® program creates a standard color scheme that represents the range in resistivity of the calculated model section, where the lowest resistivity values (in this case, approximately two [2] to four [4] Ohm/meters [Ohms/m]) are assigned a dark blue color and the highest resistivity values are assigned a red color. To facilitate discussion of resistivity values and to compare and contrast between transects, this standard color scheme was modified and used to create one (1) standard color scheme (colors ranging from dark blue to yellow to light brown and resistivity values ranging from approximately two (2) to 1000 Ohms/m) for all of the model sections generated for this project. Interpretations of the resistivity values were made by plotting known lithologies on the model sections at the appropriate tie location and determining what corresponding range of resistivity values was indicated. Depths to Franciscan bedrock were plotted for each boring location and a close-as-possible depth match was made to tie points by adjusting the depth factor in EarthImager2D®. On occasion, an apriori resistivity model was created based on tie points and used to constrain the inversion result.

To identify the overlying terrace deposits/Franciscan bedrock interface using the electrical resistivity model sections, experience at similar project areas was used. Given that the nature of bedrock in this area is the Franciscan Complex which generally consists of a sheared siltstone, mudstone or sandstone the interpretation of depth to bedrock on a given transect was made by identifying the depth at which an obvious decrease in resistivity occurred in the sections, where generally the resistivity of overlying soils was approximately 900 to 1000 Ohms/m (light brown colors in the model sections) and the top of the Franciscan was 700 Ohms/m (gold color) where the contact was a sandstone and approximately 200 Ohms/m or less (yellow to grey colors) where the contact was a sheared siltstone.

Interpretations of buried seastacks were made based on the assumption that these features would be more electrically resistive than the surrounding Franciscan matrix, and that they would be associated with abrupt changes in the topography of the bedrock surface. A brief discussion of results on a line by line basis follows.

4.2.1.1.1 Line 1 Interpretation

The resistivity data collected along Line 1 were mostly of high quality, although the effects of the utilities near the Memorial Lighthouse and at the east end of Line 1 needed to be removed from the raw pseudosections before a valid inversion of the data could be run. Both Schlumberger and dipole-dipole data sections were reviewed; however the Schlumberger inversion results appear to match more closely with the bedrock tie at boring SB-15 and with the preliminary seismic reflection interpretations. Therefore, bedrock interpretations were made from the Schlumberger results.

The elevation of the top of bedrock along Line 1 was interpreted based on a decrease in resistivity from approximately 1000 Ohms/m to 700 Ohms/m (gold color) in the model section. The elevation of the top of bedrock is in the range of approximately 114 to 116 feet MSL from at least Station 50 to Station 157. At approximately Station 173 the bedrock rises to an elevation of approximately 123 feet MSL and maintains a relatively constant elevation to Station 198; this bedrock rise may be associated with a seastack. An interpreted bedrock low (elevations between approximately 102 feet and 105 feet MSL) between Stations 198 and 223 may be associated with a paleochannel. This interpretation is backed up by the presence of resistive material (likely sands) above the bedrock contact in this area. Another bedrock high occurs at Station 262 and the shape of this bedrock high indicates it may be associated with a seastack. A dominant bedrock high (at approximately 150 feet MSL) occurs between Stations 332 and 367, and an interpreted seastack (at approximately 158 feet MSL) occurs at Station 386. This apparent seastack feature was observed in both the raw reflection records and the electrical resistivity sections. The tie with boring SB-15 is within a few feet, where sandstone bedrock was found at approximately 23 feet bgs. East of Station 404, the bedrock drops to an elevation of approximately 118 feet MSL, where an apparent paleo-channel feature exists to at least Station 472. Beyond Station 472 the electrical resistivity data are not well resolved at depth because of the taper-off effect of the sample points at the end of the line.

4.2.1.1.2 Line 2 Interpretation

The raw resistivity data collected along Line 2 were somewhat noisy; the effects of the utilities at the junction of Main and Stagecoach were readily observed in the dipole-dipole data and removed. Several inversions were attempted with both the dipole-dipole and Schlumberger. The subsurface of this area is highly complex along Line 2, with several faults and at least one (1) paleochannel indicated. After much comparison and numerous attempts to match the resistivity results to the reflection interpretations, it was decided to merge the data set of both Schlumberger and dipole-dipole data. Final interpretations of bedrock and structural features were made from inversion of this combined data file.

4.2.1.2 Seismic Reflection

Seismic interpretation requires understanding that the seismic profile represents a seismic wavefield image of the subsurface geology. The seismic profile is not a direct geologic cross-section but an interpreter with geological knowledge must pick what are real stratigraphic and structural features in the subsurface. For the hammer data, which involve minimum-phase wavelets, horizon picks should fall at the beginning of a waveform, or at the zero crossing between positive and negative wave peaks. Because the lines are short, the seismic image is presented as a wiggle trace overlying a variable density background with color representing amplitude and polarity of the waveforms. Most geological strata are relatively flat-lying near the surface for young sediments, especially on the sub-horizontal surfaces represented by erosional marine terraces as exist in Trinidad and elsewhere in the coastal areas of California. As observed on the beach, there may be sea stacks of widely varying sizes, and there may be boulders scattered on the former beach or erosional terrace surface. Channels eroded into the wave-cut terrace, composed of Franciscan bedrock, are also likely to be present. These channels may have been cut by ancient streams after the terrace was uplifted by tectonic activity, or may be related to coastal streams which were active when the terrace was cut. In the tectonically-active area of northern California, where the Cascadia Subduction Zone produces major earthquakes with large coastal uplift, shallow faulting is expected. Faults are identified by systematic offset of the sub-horizontal reflections in the seismic profile.

The final migrated seismic profiles were prepared as depth sections using the velocity model described above. The datum elevation at the zero depth line is identified at the upper right of each profile. Borehole and well data from the area were plotted on the seismic profiles at the appropriate scale and location to correlate geological horizons in the borehole logs to prominent reflections apparent in the seismic image. The most prominent reflection horizon is the top of the Franciscan bedrock identified by the purple lines on the seismic profiles (Figure A-3, Appendix A). The seismic character of this reflection is at the zero crossing below a strong positive (black) reflector above an equally strong negative (red) reflector. The reflections below the bedrock interface appear broader due to lower frequency content (attenuation of high frequencies with depth and high seismic velocities that produce longer wavelengths for the set frequency bandwidth. The bedrock surface is irregular for all of the profiles due to tectonic and erosional processes.

Immediately above the bedrock surface, alluvial strata consisting of coarse sands, gravels, cobbles and possibly boulders and weathered bedrock exist as a lag deposit and produce the variably-colored reflectors at the base of the strong positive waveform. This coarse layer was identified in several of the borehole/well logs (for example, soil boring/monitoring well SB-2/MW-6). Multiple bands of positive and negative reflection energy are apparent in the seismic profiles above the bedrock interface. These are interpreted to represent multiple layers of fine sands, silty-sands, silts, and possibly clay that are also recognized in monitoring well logs. Two (2) prominent horizons have been interpreted (yellow and green). The shallow yellow horizon follows the zero crossing below the uppermost strong positive reflector and above another strong negative reflector. The green horizon is interpreted at the top of the strong positive reflector above the bedrock surface. This horizon appears to follow the top of the ground water based on the monitoring well logs.

In some areas, prominent reflectors appear to sag into deeper layers. These reflectors are interpreted as buried channels (paleochannels) associated with sub-aerial streams cut during sea level lowstands and filled by subsequent sea-level rise. Broad channels (approximately 50 feet to 100 feet wide) appear on Line 4 near the center and the north end of the profile. An approximate 250 feet to 300 feet wide sag, apparent on Line 2 is interpreted to represent the buried valley cut into bedrock that has been partially filled, but still exists in the modern topography.

Major faults appear to bound this valley, cutting through the bedrock and into the deeper alluvium. Normal separation is apparent on the northern fault, which lies within approximately 500 feet of the Trinidad fault. This may be a fault splay that accommodates some component of strike-slip as these faults evolve from subduction-induced thrusting into right-slip associated with the northward migrating Mendocino Triple Junction and the San Andreas fault system. The southern fault may also exhibit normal separation, but the aliased data to the south obscure the offset character.

A prominent bedrock uplift or sea stack is interpreted along the central part of Line 1. This feature corresponds to the shallow bedrock (23 feet depth) encountered in boring SB-15 and the deeper (approximately 70 feet) channel at the East end of the profile sampled by boring/monitoring well SB-18/MW-9. The pattern of the strong/wide red over black reflectors appears to be repeated on the eastern half (two-thirds) of Line 4, which suggests a multiple or echo of the strong reflection interfaces of the ground water and bedrock surfaces. Further analysis is needed on this complex profile.

Line 3 was acquired using the “Whacker” source, so that the reflection data consist of zero-phase wavelets. The horizon “picks” follow the peaks or troughs of the strong reflection energy rather than the zero crossings used for minimum phase data. A small channel, possibly controlled by some high-angle faulting at the northeast end of the profile is interpreted. In addition, a prominent low-angle fault, possibly related to ancient subduction structure, is inferred within the Franciscan bedrock.

5.0 Site Conceptual Model

The site conceptual model is the compilation of all the information presented in this report. It presents the composition of the subsurface soils and bedrock along with their physical properties. This information is used to describe the movement of groundwater: into, through, and out of the project area. The information presented in the conceptual model will be used to develop the groundwater model and aid in the stormwater treatment and infiltration alternatives design process.

In order to design stormwater treatment and infiltration alternatives, information about the physical characteristics collected and calculated during this investigation should be utilized. The project area subsurface conceptual physical model parameters should include, but not be limited to:

- The size, shape, and orientation of the underlying bedrock surface;
- The thickness of the marine terrace, along with its observed and calculated physical and hydrological characteristics; and,
- The estimated project area aquifer inputs (rainfall, septic, irrigation, etc.).

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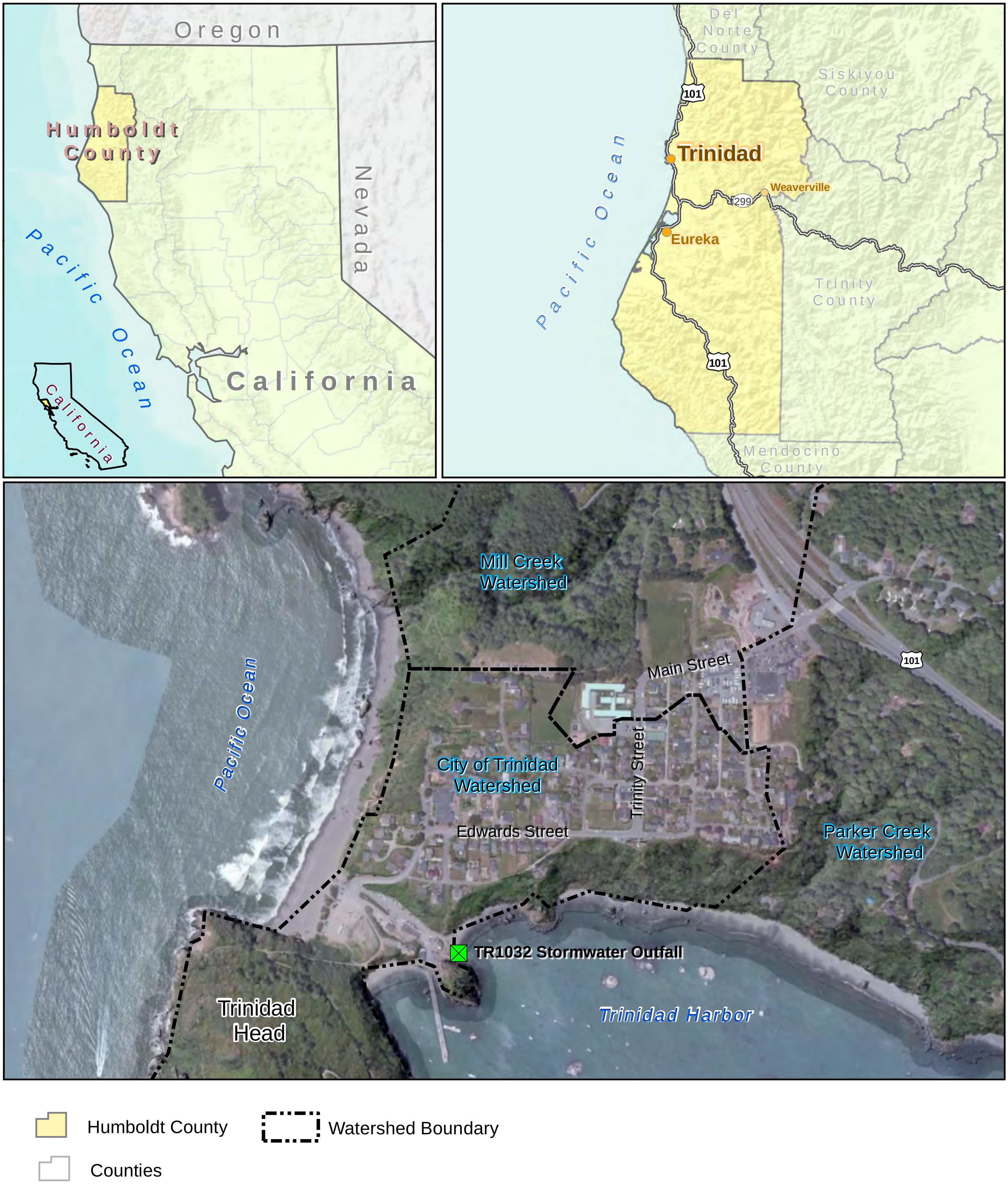
GHD Inc.

718 Third Street
Eureka, CA 95501 USA
T: 1 707 443 8326 **F:** 707 444 8330 **E:** eureka@ghd.com

Appendix A
Figures



Paper Size ANSI A
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Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	1016311005
Revision	1
Date	11 Oct 2012

Vicinity Map
City of Trinidad

Figure A-1

718 Third Street Eureka, CA 95501 **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-1_Vicinity.mxd

Data source: StreetMapUSA, Roads, Boundaries, 2010. Bing Aerials, Aerial Imagery, 2012. Created by:bvivyan

Paper Size 11" x 17" (ANSI B)

0 100 200 300 400 500 600

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Soil Boring

Monitoring Well

Preexisting Monitoring Well

Transect

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	11 Oct 2012

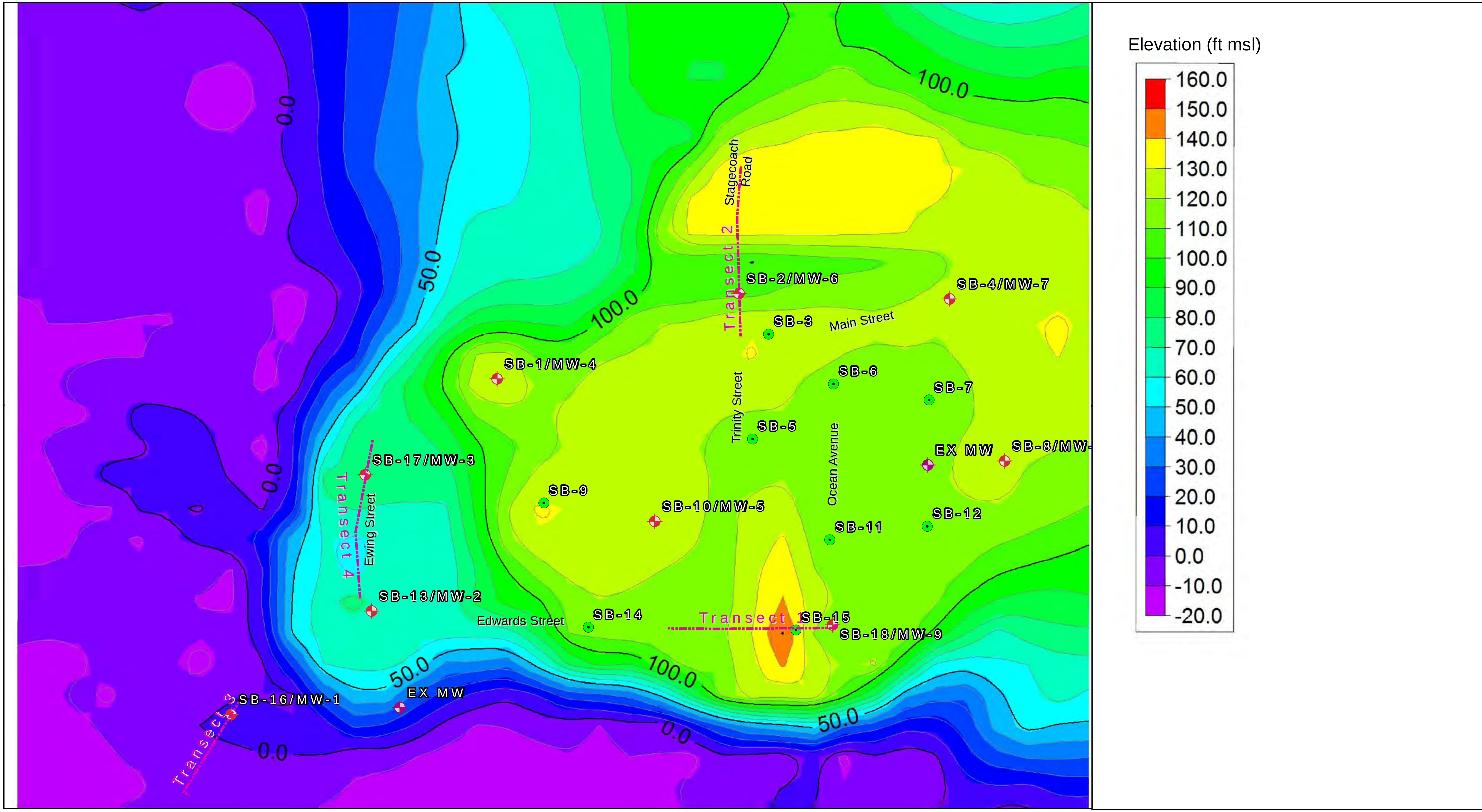
Site Map
Boring and Monitoring Well Locations

Figure A-2

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-2_Site_Map.mxd

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com



Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

- Soil Boring
- Monitoring Well
- Preexisting Monitoring Well
- Geophysical Transect (Seismic Reflection & Electrical Resistivity)

GHD

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	12 Oct 2012

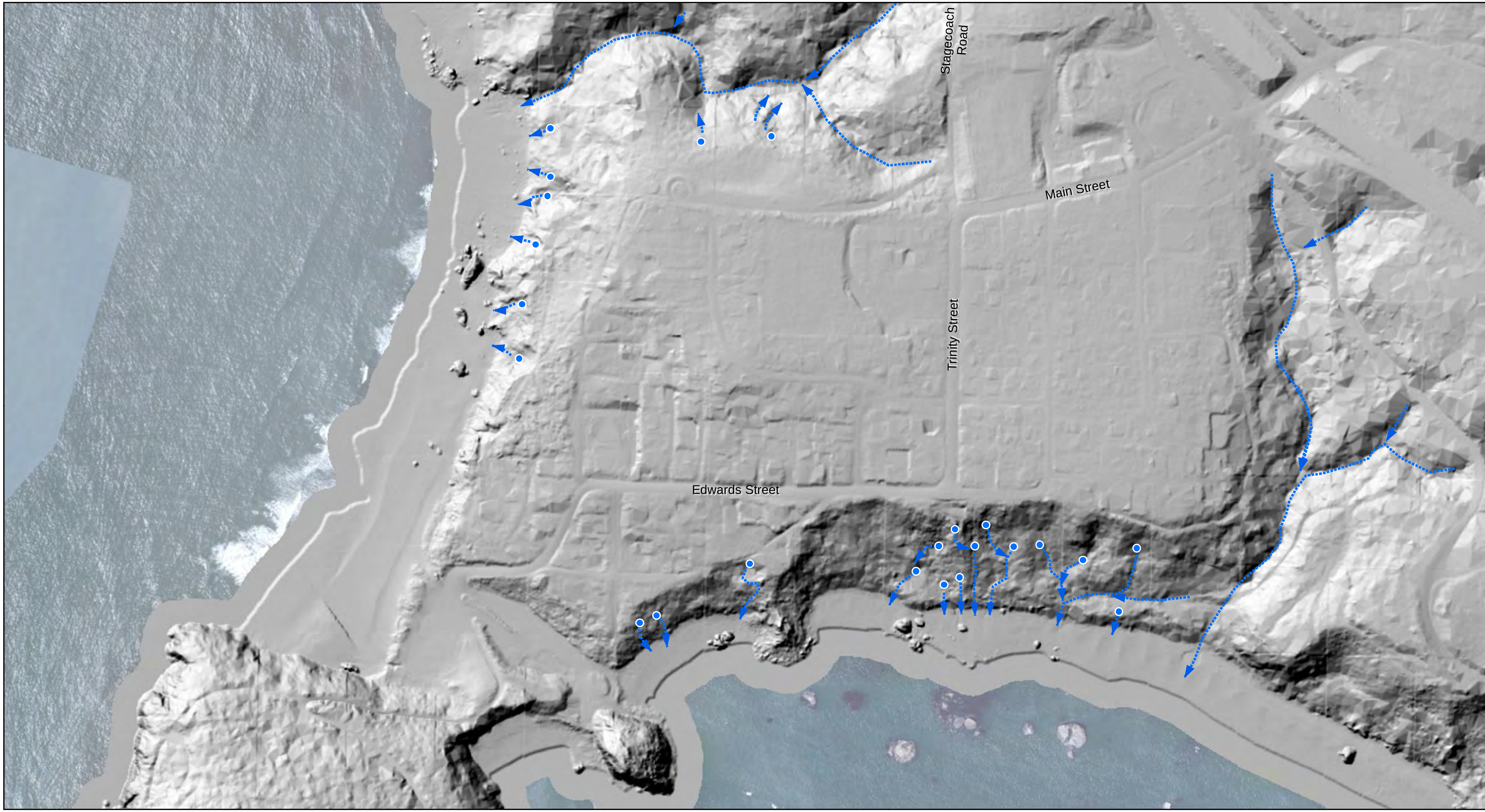
Site Map
Bedrock Surface Model

Figure A-3

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-3_Bedrock_Surface.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan



Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Seep

Flow Path

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	12 Oct 2012

Springs and Seeps Around the City of Trinidad

Figure A-4

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-4_Springs_Seeps.mxd

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan

Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

- Soil Boring
- Monitoring Well
- Preexisting Monitoring Well
- Groundwater Sections

Calculated groundwater flow direction (Azimuth) and hydraulic gradient.
Size of the arrow is relative to gradient magnitude. Where azimuth or hydraulic gradient are not indicated, groundwater flow direction has been inferred from the bedrock model (See Figure A-3).

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	12 Oct 2012

Groundwater Flow Paths
March 2012 (Wet Season)

Figure A-5

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-5_GW_Flow_March.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan

Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

- Soil Boring
- Monitoring Well
- Preexisting Monitoring Well
- Groundwater Sections

Calculated groundwater flow direction (Azimuth) and hydraulic gradient.
Size of the arrow is relative to gradient magnitude. Where azimuth or hydraulic gradient are not indicated, groundwater flow direction has been inferred from the bedrock model (See Figure A-3).

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	12 Oct 2012

Groundwater Flow Paths
September 2012 (Dry Season)

Figure A-6

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-6_GW_Flow_September.mxd

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan

Paper Size 11" x 17" (ANSI B)

0 100 200 300 400 500 600

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Cross Section

Soil Boring

Monitoring Well

Preexisting Monitoring Well

GHD

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	12 Oct 2012

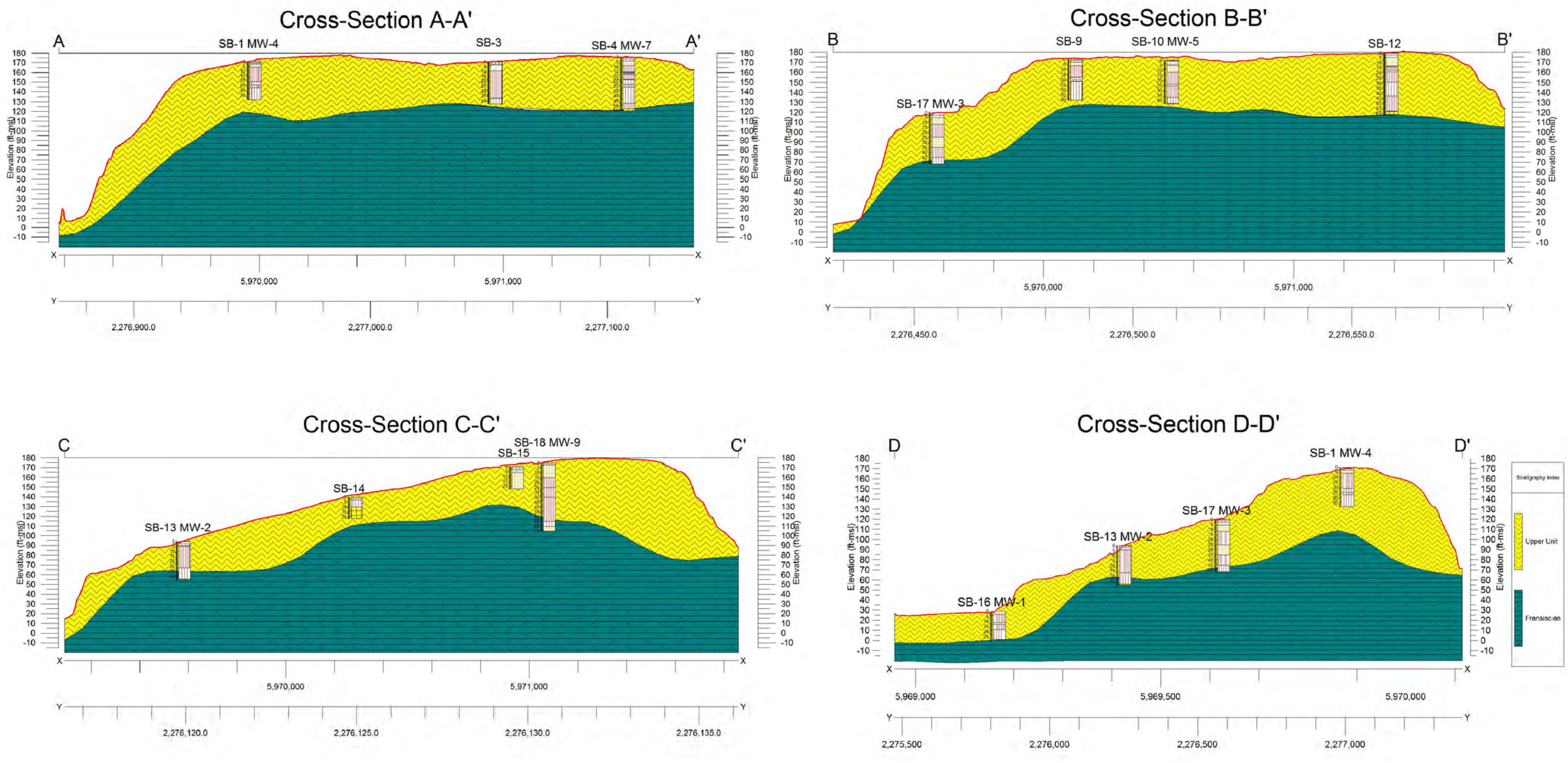
Project Area Cross Sections
A-A' through G-G'

Figure A-7

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-7_Cross_Sections.mxd

718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan



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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	12 Oct 2012

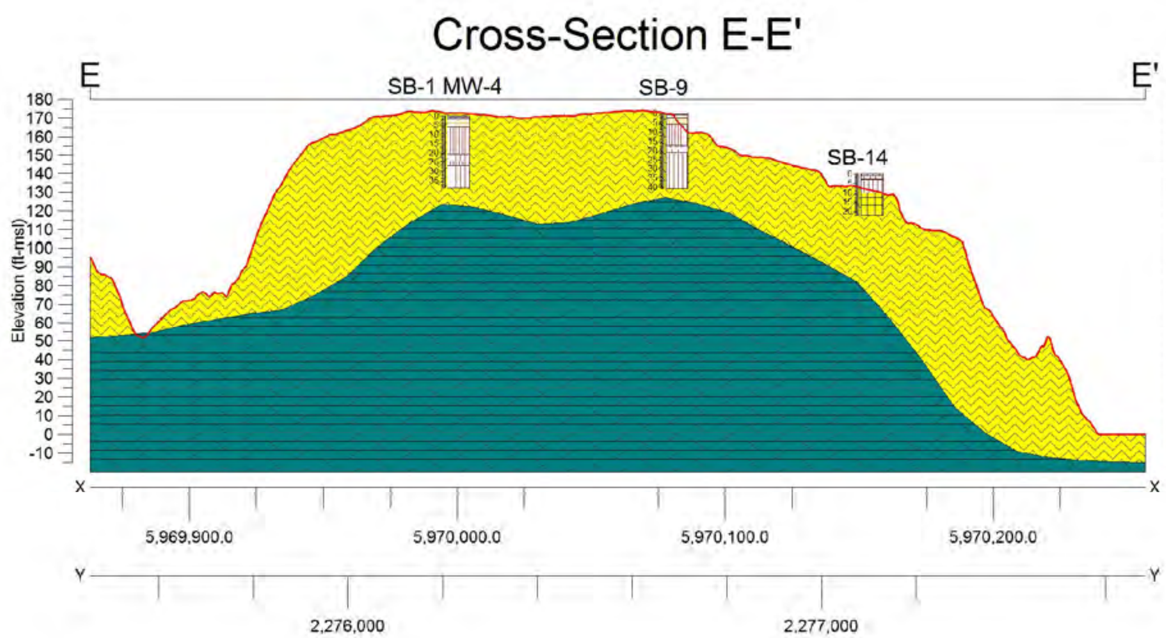
Cross Sections
A-A', B-B', C-C', D-D'

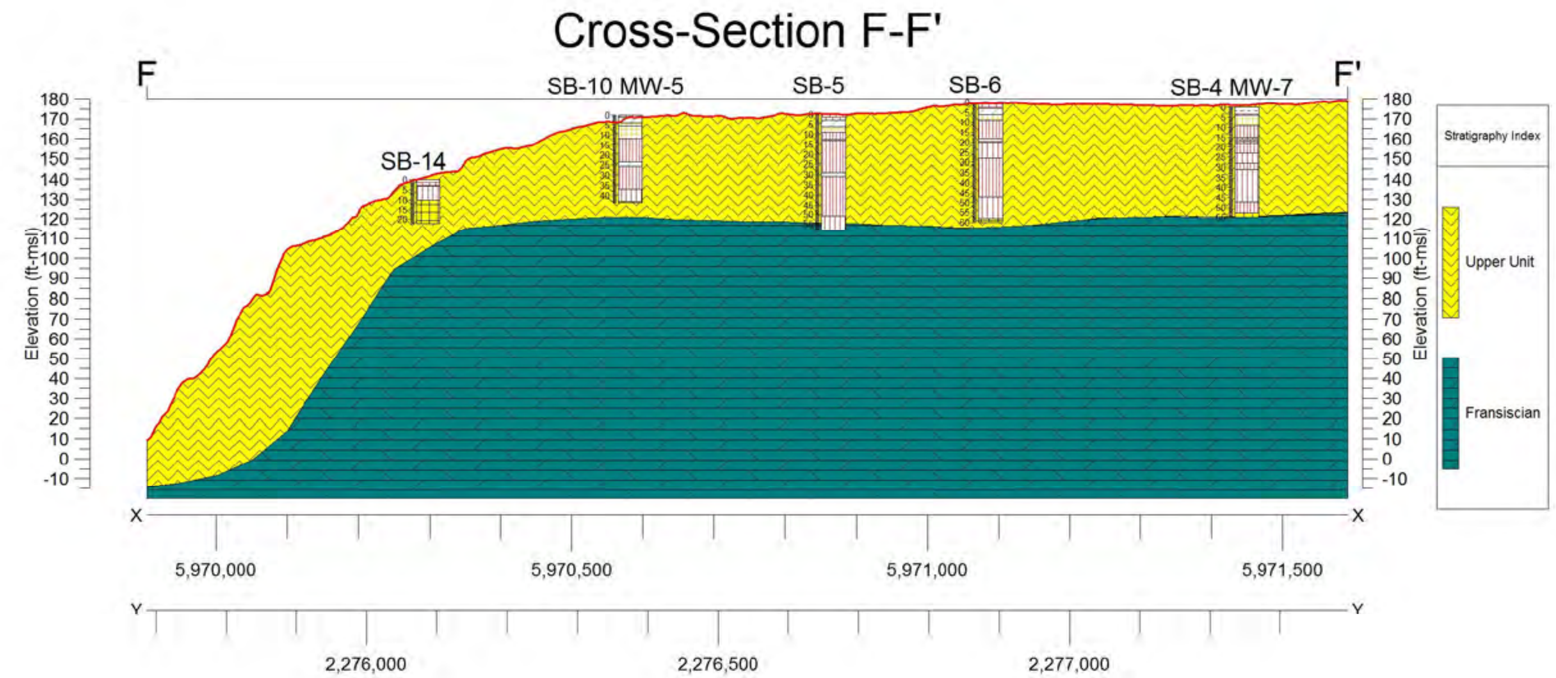
Figure A-8

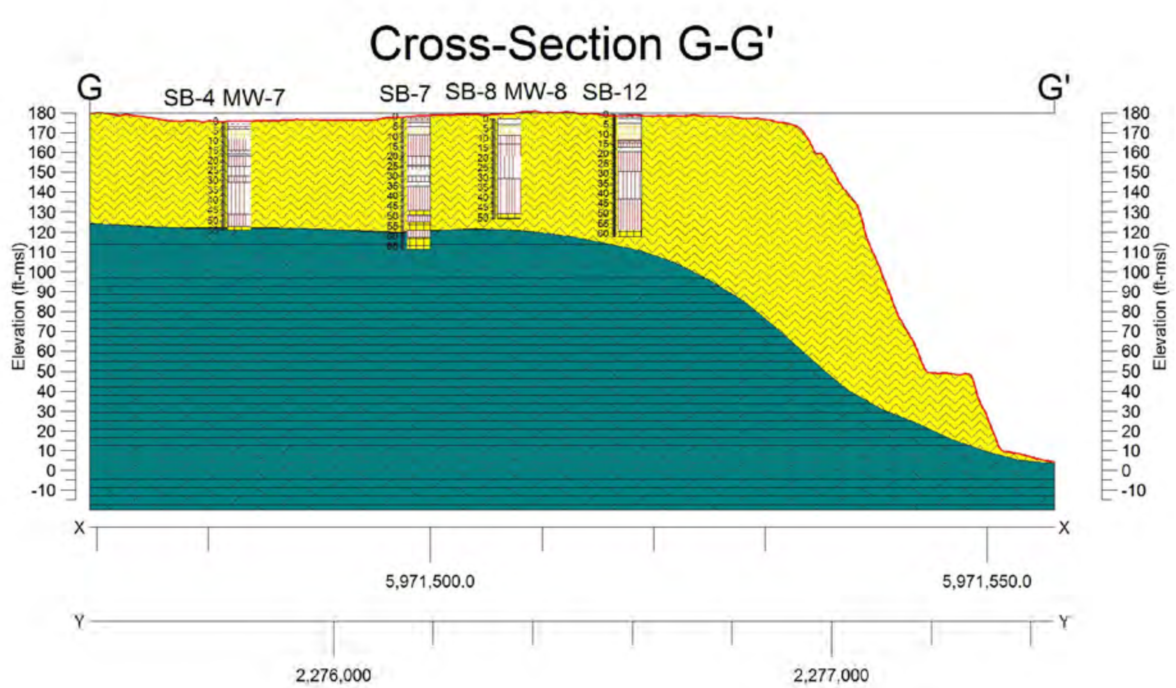
G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-8_Cross_Sections_A-D.mxd

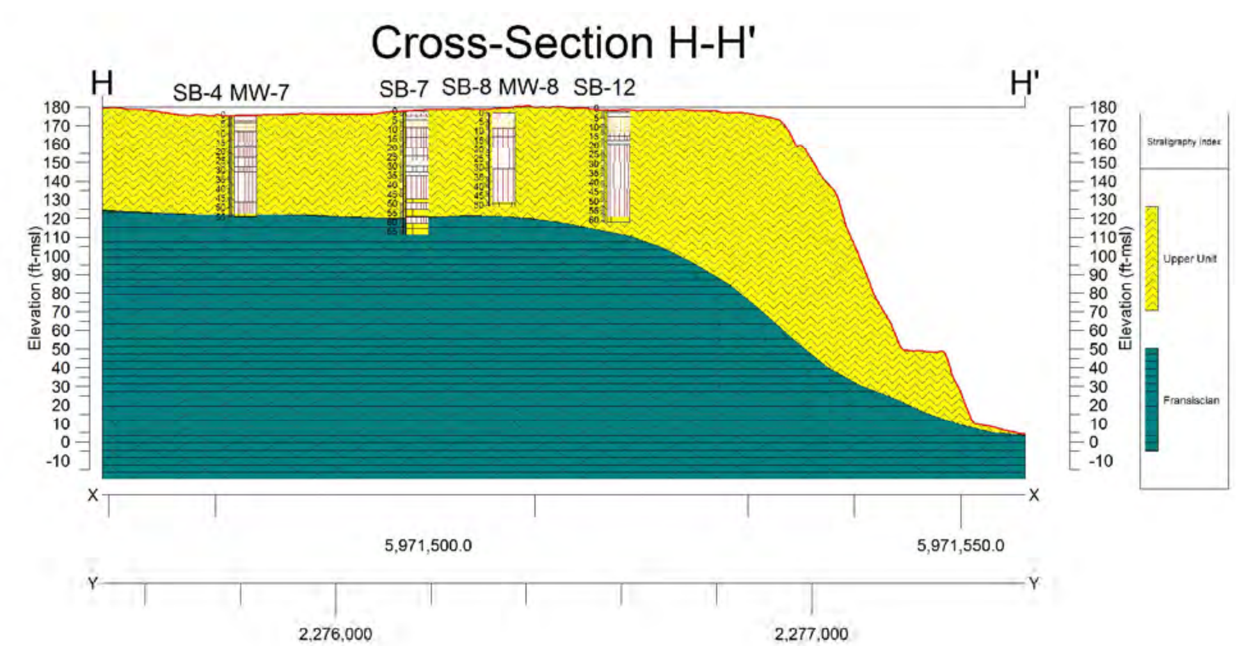
Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com









Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number	0106311005
Revision	A
Date	12 Oct 2012

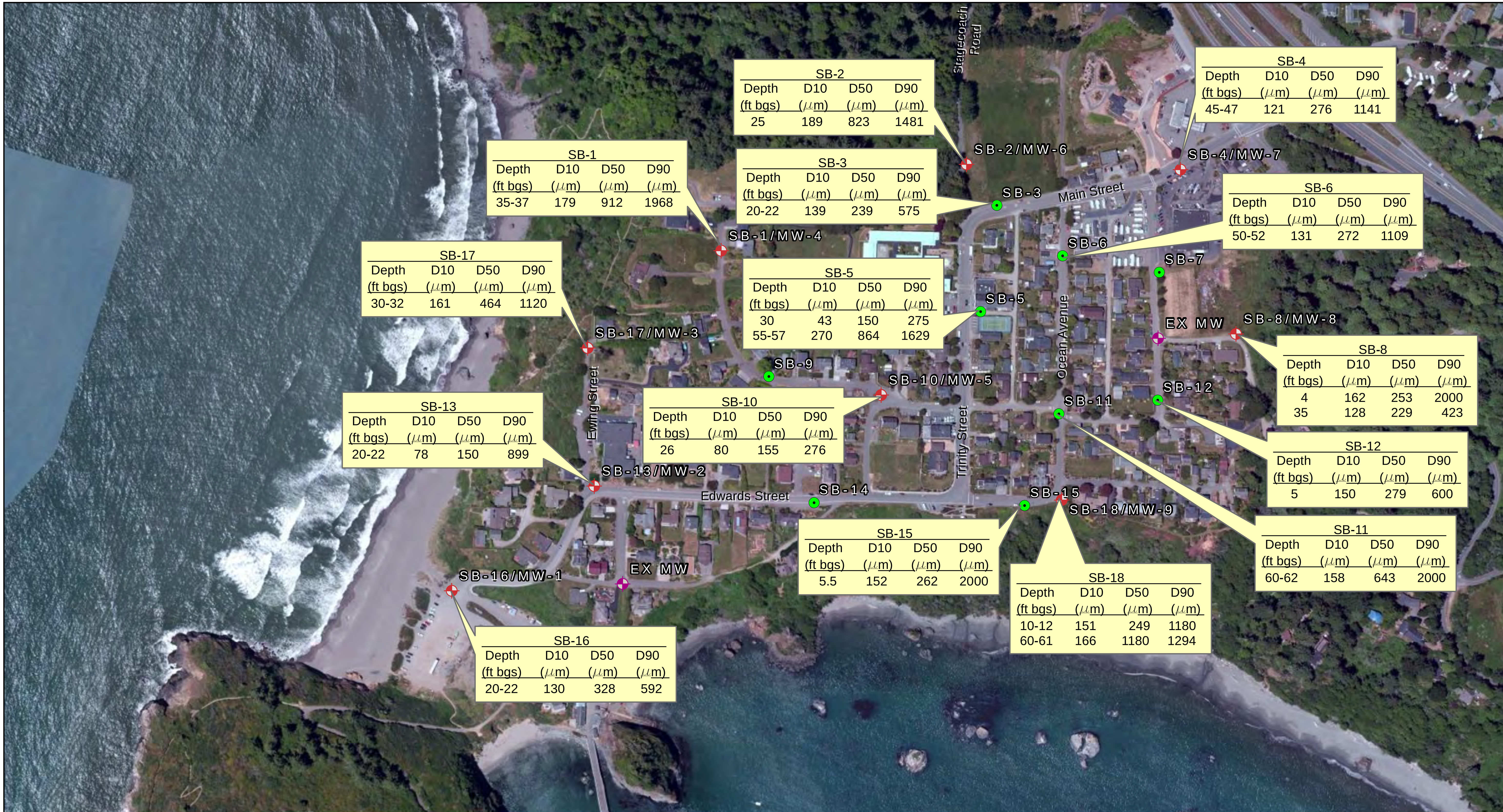
Cross Sections
E-E', F-F', G-G', H-H'

Figure A-9

G:\01063 City of Trinidad\01063-11-005 Trinidad ASBS Stormwater Ph1\08-GIS\Maps\Figures\FA-9_Cross_Sections_E-H.mxd

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com



SB-1

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
35-37	179	912	1968

SB-2

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
25	189	823	1481

SB-3

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
20-22	139	239	575

SB-4

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
45-47	121	276	1141

SB-5

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
30	43	150	275
55-57	270	864	1629

SB-6

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
50-52	131	272	1109

SB-8

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
4	162	253	2000
35	128	229	423

SB-10

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
26	80	155	276

SB-11

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
60-62	158	643	2000

SB-12

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
5	150	279	600

SB-13

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
20-22	78	150	899

SB-15

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
5.5	152	262	2000

SB-16

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
20-22	130	328	592

SB-17

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
30-32	161	464	1120

SB-18

Depth (ft bgs)	D10 (μm)	D50 (μm)	D90 (μm)
10-12	151	249	1180
60-61	166	1180	1294

Paper Size 11" x 17" (ANSI B)

0 100 200 300 400 500 600
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Soil Boring
Monitoring Well
Preexisting Monitoring Well

*Soil diameters interpolated from sieve anaysis

City of Trinidad
Trinidad ASBS Stormwater Phase 1

Job Number 0106311005
Revision A
Date 12 Oct 2012

Grain Size Anyalysis
City of Trinidad

Figure A-10

Data source: Bing, Aerial Maps, 2012. GHD Inc., Field Points, 2012. Created by:bvivyan

Appendix B
HCDEH Boring and Monitoring Well Permit

RECEIVED
JAN - 4 2012

HUMBOLDT COUNTY DIVISION of ENVIRONMENTAL HEALTH - HAZARDOUS MATERIALS UNIT
WELL and BORING PERMIT APPLICATION

Facility ID # COT **Permit #** COT 01042012

Facility Name: CITY OF TRINIDAD

Site Address: CITY LIMITS

Site Owner: CITY OF TRINIDAD **Telephone:** (707) 677-0223

Address: 409 TRINITY STREET, PO BOX 390 **AP#:** 042-061-018

RP Name: SAME, CONTACT REBECCA PRICE-HALL **Telephone:** (707) 677-3759

Address:

Consultant: WINZLER & KELLY / GHD **Telephone:** (707) 443-8326

Address: 718 3RD ST. EUREKA, CA, RYAN CRAWFORD **Reg.#/Type:** PG# 8744

Driller: Clear Heart Drilling, Inc **Telephone:** 707-568-6095

Address: 555 W. College Ave. Suite B, Santa Rosa 95401 **C-57 Lic.#:** 780357

# On-site				# Off-site			
Wells	8	Borings	17	Wells		Borings	

Activity: ☒ Construct ☐ Destroy ☐ Repair/Modify **Electrode Type:**

Well Type: ☒ Monitoring Well ☐ Injection Well ☐ Vapor Extraction ☒ Geologic Boring ☐ Extraction Well ☐ Piezometer ☐ Vapor Point ☐ Soil Gas Survey ☐ Vadose Well ☐ Cathodic Protection ☐ Direct Push Boring ☐ Temporary Well Point

Investigation Type: ☒ Site Assessment ☐ Disposal Practice ☐ UST ☒ Other* ☐ Surface Contamination ☐ Surface Impoundment ☐ AST

*Specify: STORMWATER IMPROVEMENT DESIGN

Investigation Phase: ☒ Initial ☐ Subsequent ☐ Remediation ☐ Closure

Suspected Contaminants: NA

Disposal/Containment for Soil Cuttings: 55 GAL DOT DRUMS / ROLL OUT BINS

Disposal/Containment for Rinsate: 55-GAL DOT DRUMS

Disposal/Containment for Development Water: 55-GAL DOT DRUMS

Permits will not be processed with out the following information:

☒ **Scaled Construction Detail**
☒ **Detailed Site Plan**
☐ **Lead Agency Approval Letter**
☐ **Off Site Well Requirements:**
- ☐ **Legal Right of Entry**
- ☐ **Off Site Address/Location**
- ☐ **Encroachment Permit**
- ☐ **Coastal Zone Permit**

☒ **Appropriate Fees**
☐ **Copy of Workplan (if not on file at HCDEH)**

Proposed Work Date: 1-9-2012

HUMBOLDT COUNTY DIVISION of ENVIRONMENTAL HEALTH - HAZARDOUS MATERIALS UNIT
WELL and BORING PERMIT APPLICATION

Facility ID # COT **Permit #** COT 01042012

I hereby agree to comply with all laws, ordinances and regulations of the county of Humboldt and State of California pertaining to water well construction. I will contact the Humboldt County Hazardous Materials Unit at (707) 445-6215 five (5) working days prior to commencing this work. I will furnish to the County of Humboldt, Division of Environmental Health, and the owner a legible copy of the State Water Well Completion Report (form DWR 188) within fifteen (15) days after completion of work to obtain final approval of the well(s). I acknowledge that the application will become a permit ONLY after site approval by the Local Implementing Agency (HCDEH, NCRWQCB, DTSC, EPA). I understand this permit is not transferable and expires one hundred twenty (120) days from the date of issuance.

Certificates of Insurance:

☒ A currently effective General Liability Certificate of Insurance is on file with this office, endorsed to include the Humboldt County Division of Environmental Health as additional named insured.

☒ A currently effective Worker's Compensation Certificate of Insurance is on file with this office, endorsed to include the Humboldt County Division of Environmental Health as additional named insured.

Terri White
Signature of Well Driller - no proxies - original signature only in blue ink

12/16/2011
Date

- **Well identification number and type must be affixed to exterior surface of security structure.**
- **The applicant is responsible for notifying Underground Services Alert at least 48 hours prior to the scheduled work date.**
- **A State of California Department of Water resources Well Completion Report (Form DWR 1-88) must be filed within 15 days of completion of work for all well completions and destructions.**
- **A licensed California C-57 Well Driller is required for all wells and direct push work.**

FOR OFFICE USE ONLY

Permit Approval: Norman Cranford ✓916 **Date:** 1 - 5 - 2012

Fee: $1108.00 **Date:** 1/4/12 **Receipt:** 250886 SR0000297

IN0004198

Initial Inspection: ______ **Date:** ______

Final Inspection: ______ **Date:** ______

Appendix C
Boring Logs

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-1

DATE BEGAN: 1/12/12

DRILLER: CLEARHEART DATE FINISHED: 1/13/12 FIELD GEOLOGIST: R. CRAWFORD

C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA STABLE DEPTH TO GW: 36.65' INITIAL DEPTH TO GW: 36'

DRILLING METHOD: HSA DRILLING EQUIP: 5' SOLID FLIGHT TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	SAMPLE NOTES ~~WELL CONSTRUCTION~~
0	0	GRASS COARSE GRAVEL/SAND/SILT FILL GRAVEL UP TO 6"		MOIST	LOOSE	GW	HAND AUGER TO 5' BGS
-2	2	SILT WITH SAND (85,15,0) FINE GRAINED SAND, DARK YELLOWISH BROWN, NON-PLASTIC.	10YR 4/6	MOIST	FIRM	ML	
-3	3	SILTY SAND (20,80,0) FINE GRAINED SAND, LIGHT YELLOWISH BROWN	10YR 6/4	MOIST	LOOSE	SM	
-5	5	MOTTLING FROM 4-6' BGS POORLY GRADED SAND W/SILT (10,90,0) FINE GRAINED SAND, LIGHT YELLOWISH BROWN. FINES REDUCED AT DEPTH	10YR 6/4	MOIST	LOOSE	SP-SM	FROM CUTTING
-10	10	STRONG ORANGE BANDED/OXIDIZED LAYERS 10.5'-18.5' BGS 1" THICK ROUNDED GRAVEL LENSE UP TO 1/2" DIAMETER		MOIST			SAMPLE 100%
-15	15	16'-17' OXIDIZED LAYERS WITH CHARCOAL					SAMPLE 100%
-20	20	4" THICK ROUNDED GRAVEL LAYER, 1/2" DIA. WELL GRADED SAND (5,95,0) FINE TO COARSE SAND, SUB-ROUNDED, LIGHT BROWNISH GRAY, STRONG OXIDIZED LAYER AT 22' BGS 1/2" THICK.	10YR 6/2	MOIST	LOOSE	SW	SAMPLE 100%
-24	24	POORLY GRADED SAND (1,99,0) FINE SAND, LIGHT BROWNISH GRAY.	10YR 6/2	MOIST	MED. DENSE	SP	

Drafted ~~1/9/2012~~ 1/12 - 1/13/12

 WINZLER & KELLY

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** CONT. SB-1

DATE BEGAN: 1/12/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/13/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 36' **INITIAL DEPTH TO GW:** 36'
DRILLING METHOD: HSA **DRILLING EQUIP:** 5' CORE BARREL, 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25	25	CONT. SP, SAME AS ABOVE						SAMPLE 100%
-27	27	WELL GRADED SAND (1,99,0) FINE TO COARSE SUBROUNDED TO SUBANGULAR SAND. OVERLYING CONTACT AT 27' AND AT 29' MARKED WITH STRONG OXIDIZED LAYER 1/2" THICK.	SAME	MOIST	MED. DENSE	SW		LAST CORE BARREL, TOO SLOW
-29 (1/12/12)	29							
-31	31							DRILL OUT
-32 (1/13/12)	32							
-34	34							SWITCH TO 2' SAMPLER
-35	35		SAME	MOIST	LOOSE		3 3 4 11	90% SAMPLE
-36	36	▽ ▼ (groundwater)						
-38	38	RIG STARTED RATTLING @ 37' BGS						
-39	39	BEDROCK @ 39'					17 21 50 -	75% SAMPLE FOR 5"
-41	41	BOH = 39' 0845 1/13/12						
-50	50							

SOIL BORING AND WELL LOG

PROJECT NO: 01631065 PROJECT NAME: TRINIDAD ABBS BORING NUMBER: SB-2

DATE BEGAN: 1/13/12
DRILLER: CLEARHEART DATE FINISHED: 1/17/12 FIELD GEOLOGIST: R. CRAWFORD
C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA STABLE DEPTH TO GW: 19.90' ▼ INITIAL DEPTH TO GW: 19' ▽
DRILLING METHOD: HSA DRILLING EQUIP: 5' CORE BARREL TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
0 to -5	0–5	GRASSY GRAVEL/SAND/SILT FILL		MOIST	LOOSE	GW	HAND AUGER TO 5' BGS
-5 to -10	5–10	POORLY GRADED SAND (5,95,0) FINE GRAINED SAND, LIGHT YELLOWISH BROWN.	10YR 6/4	MOIST	LOOSE	SP	DRILL TO 10' DESC. FROM CUTTINGS
-10 to -15	10–15	WELL GRADED SAND (5,95,0) FINE TO COARSE GRAINED SAND, SUB-ROUNDED TO SUBANGULAR, YELLOWISH	10YR 5/6	MOIST	LOOSE	SW	100% SAMPLE
-15 to -20	15–20	BROWN. STRONG OXIDIZED LAYER @ 15' BGS. 15.5'-18' FINE SAND STRINGERS UP TO 3" THICK. DISCRETE OXIDIZED CONTACT @ 19' POORLY GRADED SAND (1,99,0) FINE	10YR 6/2	WET	MED. DENSE	SP	100% SAMPLE ▽ ▼
-20 to -25	20–25	SAND, LIGHT BROWNISH GRAY. ½" THICK OXIDATION LAYER @ 21' BGS WELL GRADED SAND (5,95,0) FINE TO COARSE SAND, SUB ROUNDED TO SUBANGULAR. 24.5'-25' VERY STRONG OXIDATION LAYER	SAME	WET	LOOSE	SW	80% SAMPLE

SOIL BORING AND WELL LOG

PROJECT NO: 010631005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-2
DATE BEGAN: 1/13/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/17/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** ~20' **INITIAL DEPTH TO GW:** 19
DRILLING METHOD: HSA **DRILLING EQUIP:** 5' CORE BARREL, 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
		CONT. SW AS ABOVE					
-25	25						90% SAMPLE
-26	26	OXIDATION LAYER ½" THICK @ 26' BGS	SAME	WET	LOOSE	SW	
-27	27						
-28	28						
-29	29						
-30	30	POORLY GRADED SAND (1,99,0) FINE SAND LAYER.	SAME	WET	LOOSE	SP	SAMPLE TO 33', SWITCH TO 2' SAMPLER
-31	31	WELL GRADED SAND (1,99,0) FINE TO COARSE SAND	SAME	WET	LOOSE	SW	
-32	32						
-33	33						
-34	34	STRONGLY OXIDIZED 3" ROUNDED GRAVEL LAYER WEATHERED SILTSTONE BEDROCK					
-35	35						
-36	36						
-37	37	BOH = 34' 1305 1/1					
-38	38						
-39	39						
-40	40						
-41	41						
-42	42						
-43	43						
-44	44						
-45	45						
-46	46						
-47	47						
-48	48						
-49	49						
-50	50						

Drafted ~~1/9/2012~~ 1/17/12

 WINZLER & KELLY

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-3

DATE BEGAN: 1/16/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/16/12 **FIELD GEOLOGIST:** R.CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 39' **INITIAL DEPTH TO GW:** 38'

DRILLING METHOD: HSA **DRILLING EQUIP:** 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0 to -2	0–2	ASPHALT 3" ROADBASE GRAVEL FILL TO 3' BGS		DRY	LOOSE	GW		HAND AUGER TO 5' BGS
-3 to -5	3–5	SILT WITH SAND (75,25,0) FINE SAND, DARK YELLOWISH BROWN NON PLASTIC.	10YR 4/6	DRY	SOFT	ML		
-6 to -8	6–8	SILTY SAND (20, 80, 0) FINE SAND LIGHT YELLOWISH BROWN.	10YR 6/4	DRY	LOOSE	SM		DRILL TO 10' BGS
-9 to -15	9–15	POORLY GRADED SAND (5,95,0) FINE SAND, LIGHT YELLOWISH BROWN GRAVEL LENSE, 1" THICK, ROUNDED @ 10.5' STRONG OXIDIZED LAYER ½" THICK @ 11' GRADATIONAL INCREASE IN MEDIUM SAND 12-13.5', GRADATIONAL DECREASE IN MEDIUM SAND 13.5-15'.	SAME	DRY	LOOSE-MED DENSE	SP	5 5 7 11 7 11 13 13	SAMPLE 100%
-15 to -20	15–20							DRILL TO 20' BGS
-20 to -25	20–25	SAME AS ABOVE, COLOR CHANGE LIGHT BROWNISH GRAY	10YR 6/2	DRY	LOOSE		6 6 7 9	SAMPLE 100%

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-3
DATE BEGAN: 1/16/12
DRILLER: CLEARHEART DATE FINISHED: 1/16/12 FIELD GEOLOGIST: R. CRAWFORD
C57 License #: 760357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA
SURFACE ELEVATION: NA STABLE DEPTH TO GW: 39' INITIAL DEPTH TO GW: 38'
DRILLING METHOD: HSA DRILLING EQUIP: 5', 2' SAMPLER TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
		SAME AS ABOVE						
-25	25					SP		DRILL TO 30' BGS
-26	26							
-27	27							
-28	28							
-29	29							
-30	30		SAME	DRY	MED DENSE		8	SAMPLE 100%
-31	31	@ 31' STRONG OXIDIZED LAYER ½" THICK, DIPPING ~ 35°					11	
-32	32						17	
							19	
-33	33							
-34	34	GRADATION INCREASE IN						
-35	35	SILT CONTENT 32'-38'						DRILL TO 40' BGS
-36	36							
-37	37							
-38	38	WELL GRADED SAND (5,95,0) FINE TO COARSE SAND, SUBROUNDED TO SUB ANGULAR, GRAYISH BROWN.	10YR 5/2	WET	LOOSE	SW		▽
-39	39							▼
-40	40						3	SAMPLE 100%
-41	41						3	
-42	42						5	
							10	
-43	43							
-44	44	GRAYWACKE/SANDSTONE BEDROCK @ 43' BGS					50	
-45	45							
-46	46							
-47	47	BOH = 43' 1445						
-48	48	1/16/12						
-49	49							
-50	50							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-4

DATE BEGAN: 1/17/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/17/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 44' **INITIAL DEPTH TO GW:** 43

DRILLING METHOD: HSA **DRILLING EQUIP:** CORE BARREL, 5' 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
0	0	GRAVEL/SAND/SILT FILL TO 4' BGS		DRY		GW	HAND AUGER TO 5' BGS
-4	4	SILTY SAND (20,80,0) FINE SAND, LIGHT YELLOWISH BROWN FINES REDUCING AT DEPTH	10YR 6/4	DRY	LOOSE	SM	DRILL TO 10' BGS
-9	9	POORLY GRADED SAND (5,95,0) FINE SAND COLOR CHANGE TO PALE BROWN STRONG 1" THICK OXIDIZED LAYER AT 12' BGS, FEW ROUNDED GRAVEL UP TO 3/4" DIAMETER.	SAME 10YR 6/3	DRY DRY	LOOSE LOOSE	SP	SAMPLE 100%
-15	15	WELL GRADED SAND (5,95,0) FINE TO COARSE SUBANG-SUBROUNDED SAND, LIGHT BRN GRAY.	10YR 6/2	DRY	LOOSE	SW	SAMPLE 100%
-16	16	POORLY GRADED SAND (5,95,0) FINE SAND	SAME	DRY	LOOSE	SP	
-17	17	WELL GRADED GRAVEL (0,5,95) FINE TO COARSE SAND, STRONGLY OXIDIZED, WELL ROUNDED	10YR 4/6	DRY	LOOSE	GW	
-18	18	POORLY GRADED SAND (1,95,0) FINE SAND LIGHT YELLOWISH BROWN	10YR 6/4	DRY	LOOSE	SP	
-20	20						SAMPLE 100%
-23	23	WELL GRADED SAND (1,99,0) FINE TO COARSE SUBANGULAR TO SUBROUNDED SAND, LIGHT BROWNISH GRAY, STRONG OXIDIZED LAYER AT 24' BGS	10YR 6/2	DRY	LOOSE	SW	
-25	25						

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-4

DATE BEGAN: 1/17/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/17/12 **FIELD GEOLOGIST:** R.CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 44' ▽ **INITIAL DEPTH TO GW:** 43 ▽

DRILLING METHOD: HSA **DRILLING EQUIP:** 5, 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25 to -30	25–30	STRONG OXIDIZED LAYER @ 26' BGS POORLY GRADED SAND (1,99,0) FINE SAND, LIGHT YELLOWISH BROWN	10YR 6/4	DRY	LOOSE	SW (25–28); SP (28–30.5)		SAMPLE 100%
-30 to -35	30–35	WELL GRADED SAND (1,99,0) FINE TO COARSE SUBANG-SUBROUNDED SAND. 1/2" THICK OXIDIZED LAYER AT 33' BGS.	SAME	DRY	LOOSE	SW		SAMPLE 100%
-35 to -40	35–40	STRONG OXIDIZED LAYER AT 37' BGS, TRACE COARSE GRAVEL UP TO 3/4" DIA.	SAME	DRY	LOOSE			SAMPLE 60% STOPPED @ 38' DRILL TO 40
-40 to -45	40–45	STRONG OXIDIZED LAYER AT 41' BGS 3/4" THICK DIPPING ~20° COARSENING AT DEPTH	SAME	DRY	MED.-DENSE	▽ (43) ▼ (44)	9 7 11 15	2' SAMPLER 100%
-45 to -50	45–50	45-47' STRONGLY OXIDIZED, TRACE ROUNDED GRAVEL, HEAVING AT 47' POORLY GRADED SAND (1,99,0) FINE SAND, DARK YELLOWISH BROWN	10YR 4/6	WET	MED.-DENSE	SP	9 13 17 21	100% SAMPLE

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-4

DATE BEGAN: 1/17/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/17/12 **FIELD GEOLOGIST:** R.CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 44' **INITIAL DEPTH TO GW:** 43'

DRILLING METHOD: HSA **DRILLING EQUIP:** 5', 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-50	50		SAME	WET	LOOSE	SP	HEAVING SAND
-51	51						
-52	52						
-53	53	DRILL 2' INTO BEDROCK					
-54	54						
-55	55						
-56	56	BUILD WELL TO 55' BGS					
-57	57						
-58	58	BOH=55' 1410 1/17/12					
-59	59						
-60	60						
-61	61						
-62	62						
-63	63						
-64	64						
-65	65						
-66	66						
-67	67						
-68	68						
-69	69						
-70	70						
-71	71						
-72	72						
-73	73						
-74	74						
-75	75						

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-5

DATE BEGAN: 1/18/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/18/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** ~44 **INITIAL DEPTH TO GW:** 43'
DRILLING METHOD: HSA **DRILLING EQUIP:** 2' SAMPLER **TOC ELEVATION:** NA

DEPTH (ft.)	SOIL DESCRIPTION (ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.)	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0–3	GRAVEL/SAND/SILT FILL TO 3' BGS		DRY	LOOSE	GW		HAND AUGER TO 5' BGS
3–5	SILT WITH SAND (75,25,0) FINE SAND, DARK YELLOWISH BROWN NON-PLASTIC.	10YR 4/6	DRY	SOFT	ML		
5–9	SILTY SAND (25,75,0) FINE SAND, LIGHT YELLOWISH BROWN	10YR 6/4	DRY	LOOSE	SM		DRILL TO 10'
9–10	POORLY GRADED SAND (5,95,0) FINE SAND. MOTTLING/OXIDATION TO 13'	10YR 6/4	DRY	LOOSE	SP	5 5 7 9	SAMPLE 100%
13–14	COARSE ROUNDED GRAVEL LENSE UP TO 1" DIA.				GW		
14–15	POORLY GRADED SAND (5,95,0) FINE SAND.	SAME	DRY	LOOSE	SP		DRILL TO 20'
18	COLOR CHANGE TO LIGHT BROWNISH GRAY.	10YR 6/2	DRY				
20–22						5 8 11 13	SAMPLE 100%

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-5
DATE BEGAN: 1/18/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/18/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 44' **INITIAL DEPTH TO GW:** 43'
DRILLING METHOD: HSA **DRILLING EQUIP:** 5, 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25	25					SP	7	SAMPLE 100%
-26	26						11	
-27	27						13	
-28	28	ABRUPT CONTACT					17	
-29	29	SILT (95,5,0) FINE SAND	SAME	MOIST	FIRM-HARD	ML		
-30	30	NON-PLASTIC.					17	SAMPLE 90%
-31	31	POORLY GRADED SAND (5,95,0)	SAME	DRY	MED-DENSE	SP	21	
-32	32	FINE SAND.					23 27	
-33	33							
-34	34							
-35	35							DRILL TO 40' BGS
-36	36							
-37	37							
-38	38							
-39	39	4" SILT LENSE, NON-PLASTIC						
-40	40						7	
-41	41						8	
-42	42						11	
-43	43			WET			15	▽
-44	44							▼ DRILL TO 55' BGS
-45	45							
-46	46							
-47	47							
-48	48							
-49	49							
-50	50							

SOIL BORING AND WELL LOG

PROJECT NO: 010631005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-5

DATE BEGAN: 1/18/12

DRILLER: CLEARHEART DATE FINISHED: 1/18/12 FIELD GEOLOGIST: R. CRAWFORD

C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA STABLE DEPTH TO GW: 44' INITIAL DEPTH TO GW: 43'

DRILLING METHOD: HSA DRILLING EQUIP: 5', 2' SAMPLER TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-50	50					SP		
-51	51	DRILL RIG RATTLED AT 52'						
-52	52	WELL GRADED SAND (5,95,0) FINE TO COARSE SUBANG - SUBROUNDED SAND	SAME	WET	LOOSE	SW		
-53	53							
-54	54							
-55	55						7	SAMPLE 100%
-56	56						8	
-57	57						7 11	
-58	58							
-59	59	BEDROCK					50	FOR 2"
-60	60							
-61	61	BOH = 58' 1105 1/18/12						
-62	62							
-63	63							
-64	64							
-65	65							
-66	66							
-67	67							
-68	68							
-69	69							
-70	70							
-71	71							
-72	72							
-73	73							
-74	74							
-75	75							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-6

DATE BEGAN: 1/19/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/19/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** NONE **INITIAL DEPTH TO GW:** NONE
DRILLING METHOD: HSA **DRILLING EQUIP:** 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0 to -3	0–3	~~ASPHALT 3"~~ GRAVEL/SAND/SILT FILL TO 3'		DRY	LOOSE	GW		HAND AUGER TO 5'
-3 to -5	3–5	SILT WITH SAND (75,25,0) FINE SAND, LIGHT YELLOWISH BROWN, NON-PLASTIC.	10YR 6/4	DRY	LOOSE	ML		
-5 to -9	5–9	SILTY SAND (25,75,0) FINE SAND.	SAME	DRY	LOOSE	SM		DRILL TO 10'
-9 to -15	9–15	POORLY GRADED SAND (5,95,0) FINE SAND, STRONGLY OXIDIZED 10-12'.	SAME	DRY	LOOSE	SP	5 7 6 10	SAMPLE 100% (10')
-15 to -20	15–20	RIG RATTLED, GRAVEL IN CUTTINGS WELL GRADED GRAVEL (5,10,85) FINE TO COARSE SAND, WELL ROUNDED FINE TO COARSE GRAVEL UP TO 1" DIA.	SAME	DRY	LOOSE	GW		DRILL TO 20'
-20 to -25	20–25	WELL GRADED SAND (5,95,0) FINE TO COARSE SUBANG-SUBROUNDED SAND, LIGHT BROWNISH GRAY.	10YR 6/2	DRY	LOOSE	SW	5 7 7 9	SAMPLE 100% (20')

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-6

DATE BEGAN: 1/19/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/19/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** NONE **INITIAL DEPTH TO GW:** NONE

DRILLING METHOD: HSA **DRILLING EQUIP:** 5', 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25	25					SW		DRILL TO 30' BGS
-26	26							
-27	27							
-28	28	POORLY GRADED SAND (5,95,0) FINE SAND, LIGHT YELLOWISH BROWN.	10YR 6/6	DRY	MED-DENSE	SP		
-29	29							
-30	30		SAME	DRY	SAME		11 13 17 21	SAMPLE 100%
-31	31							
-32	32							
-33	33							
-34	34							
-35	35							DRILL TO 40' BGS
-36	36							
-37	37							
-38	38							
-39	39							
-40	40						13 15 17 22	SAMPLE 100%
-41	41							
-42	42							
-43	43							
-44	44							
-45	45							DRILL TO 50' BGS
-46	46	RIG RATTLED						
-47	47	WELL GRADED SAND (5,95,0) FINE TO COARSE SUBANG - SUBROUNDED SAND, BROWNISH YELLOW	10YR 6/6	MOIST	LOOSE	SW		
-48	48							
-49	49							
-50	50							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-6

DATE BEGAN: 1/19/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/19/12 **FIELD GEOLOGIST:** R.CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** NONE **INITIAL DEPTH TO GW:** NONE

DRILLING METHOD: HSA **DRILLING EQUIP:** 5', 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-50	50						10	SAMPLE 90%
-51	51	STRONG OXIDIZED LAYER @ 51'	SAME	MOIST	LOOSE		11	
-52	52						11 13	
-53	53							
-54	54							
-55	55							DRILL TO 60'
-56	56							
-57	57							
-58	58							
-59	59	HIGHLY SHEARED SILTSTONE BEDROCK						
-60	60							
-61	61	BOH = 60' 1540						
-62	62	1/19/12						
-63	63							
-64	64	NO GROUNDWATER ENCOUNTERED						
-65	65							
-66	66	POSSIBLY @ 46' BGS						
-67	67							
-68	68							
-69	69							
-70	70							
-71	71							
-72	72							
-73	73							
-74	74							
-75	75							

SOIL BORING AND WELL LOG

PROJECT NO: 010631/005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-7

DATE BEGAN: 1/9/12

DRILLER: CLEARHEART DATE FINISHED: 1/10/12 FIELD GEOLOGIST: R. CRAWFORD

C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA STABLE DEPTH TO GW: ~40' INITIAL DEPTH TO GW: 39'

DRILLING METHOD: HSA DRILLING EQUIP: 2' SAMPLER TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	Blows	WELL CONSTRUCTION
0	0	✓ GRASS GRAVEL/SAND/SILT FILL TO 3'		MOIST	LOOSE	GW		HAND AUGER TO 5'
-3	3	SANDY SILT (55,45,0) FINE SAND, DARK YELLOWISH BROWN, NON-PLASTIC.	10YR 4/6	MOIST	FIRM	ML		
-5	5	SILTY SAND (15,85,0) FINE SAND, LIGHT YELLOWISH BROWN.	10YR 6/4	MOIST	LOOSE	SM	3 3 4 6	SAMPLE 100%
-9	9	POORLY GRADED SAND WITH SILT (10,90,0) FINE SAND, STRONG ½" THICK OXIDIZED INTERVALS OF SAND.	SAME	DRY	MED. DENSE	SP-SM	7 12 14 18	SAMPLE 100%
-14	14	POORLY GRADED SAND (5,95,0) FINE SAND, PALE BROWN 6" FINE GRAVEL LENSE, UP TO 3/4" DIA., ROUNDED.	10YR 6/3	DRY	MED. DENSE	SP	13 15 19 22	SAMPLE 100%
-19	19	WELL GRADED SAND (1,99,0) FINE TO COARSE SAND, SUBANG - SUB-ROUNDED, GRAYISH BROWN	10YR 5/2	DRY	LOOSE	SW	6 7 20 12	SAMPLE 100%
-24	24	4" STIFF SILT LAYER						

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-7

DATE BEGAN: 1/9/12
DRILLER: CLEARHEART
C57 License #: 780357
DATE FINISHED: 1/10/12
FIELD GEOLOGIST: R. CRAWFORD
NORTHING/LATITUDE: NA
EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA
STABLE DEPTH TO GW: 40'
INITIAL DEPTH TO GW: 39'
DRILLING METHOD: HSA
DRILLING EQUIP: 5', 2' SAMPLER
TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25	25	WELL GRADED SAND (1,99,0) FINE TO COARSE SAND, SUBANG - SUBROUNDED, GRAYISH BROWN.	10YR 5/2	DRY	LOOSE	SW	10, 17, 9, 17	SAMPLE 100%
-27	27	SANDY SILT (70,30,0) FINE TO COARSE SAND, DARK YELLOWISH BROWN, NON-PLASTIC	10YR 4/6	MOIST	HARD	ML		SILT IN CUTTINGS
-30	30	WELL GRADED SAND (5,95,0) FINE TO COARSE SAND, SUBANG-SUBROUND, DARK GRAYISH BROWN, TRACE FINE ROUNDED GRAVEL < 1/4" DIA.	10YR 4/2	DRY	MED-DENSE	SW	9, 13, 17, 21	SAMPLE 80%
-33	33	SANDY SILT (60,35,5) FINE TO COARSE SAND, TRACE ANGULAR GRAVEL, NON-PLASTIC	10YR 5/4	DRY	HARD	ML		
-35	35	POORLY GRADED SAND (5,95,0) FINE SAND, BROWN. STRONG OXIDIZED LAYER AT 36'.	10YR 5/3	DRY	LOOSE	SP	12, 16, 19, 21	SAMPLE 100%
-39	39			WET				▽
-40	40	SAME AS ABOVE			LOOSE		9, 7, 7, 10	▼ SAMPLE 100%
-45	45	47.5-49.5' SILICIOUS CEMENTED SAND			DENSE		15 FOR 4"	20% SAMPLE
-50	50							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-7

DATE BEGAN: 1/9/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/10/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 40' **INITIAL DEPTH TO GW:** 39'

DRILLING METHOD: HSA **DRILLING EQUIP:** 5', 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-50	50					SP	DRILL TO 66.5' BGS
-51	51						
-52	52						
-53	53	53.5-57' SILICIOS CEMENTED SAND					
-54	54						
-55	55						
-56	56						
-57	57						
-58	58						
-59	59						
-60	60						
-61	61	WEATHERED BEDROCK					
-62	62						0% SAMPLE
-63	63	HARD SILTSTONE BEDROCK					
-64	64						DRILL 3' INTO BEDROCK
-65	65						
-66	66	BOH = 66.5' 0905 1/10/12					
-67	67						
-68	68						
-69	69						
-70	70						
-71	71						
-72	72						
-73	73						
-74	74						
-75	75						

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-8

DATE BEGAN: 1/11/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/11/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: **STABLE DEPTH TO GW:** 45.5' ▽ **INITIAL DEPTH TO GW:** 45.5' ▽

DRILLING METHOD: HSA **DRILLING EQUIP:** 5' CORE BARREL **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
0	0	GRASS SILT (99,1,0) FINE SAND, DARK	10YR 5/3	WET	SOFT	ML	HAND AUGER TO 5' BGS
-1	1	BROWN, LOW PLASTICITY.					
-2	2	SANDY SILT (60,40,0) FINE SAND	10YR 4/6	MOIST	FIRM	ML	
-3	3	DARK YELLOWISH BROWN NON-PLASTIC SILTY SAND (20,80,0) FINE SAND	10YR 6/4	MOIST	LOOSE	SM	
-4	4	LIGHT YELLOWISH BROWN.					
-5	5						
-6	6	1/2" THICK ALTERNATING LAYERS					
-7	7	OF ORANGE, YELLOW, BROWN OXIDES, FROM 6-8' BGS					50% SAMPLE
-8	8						
-9	9	WELL GRADED SAND WITH SILT (10,90,0) FINE TO MEDIUM SAND, SUBROUNDED TO	10YR 6/4	MOIST	LOOSE	SW-SM	
-10	10	SUBANGULAR, LIGHT YELLOWISH BROWN					100% SAMPLE
-11	11	ABRUPT OVERLYING CONTACT. COLOR	10YR 5/6	DRY	LOOSE		
-12	12	CHANGE AT 11' BGS YELLOWISH BROWN.					
-13	13	POORLY GRADED SAND (5,95,0) FINE	10YR 6/3	DRY	LOOSE	SP	
-14	14	SAND, PALE BROWN.					
-15	15						
-16	16						100% SAMPLE
-17	17	TRACE COARSE SAND,					
-18	18	COARSENING AT DEPTH GRADATIONAL CONTACT					
-19	19	WELL GRADED SAND (1,99,0) FINE	10YR 6/2	DRY	LOOSE	SW	
-20	20	TO COARSE SAND, SUBROUNDED TO					
-21	21	SUBANGULAR, LIGHT GRAYISH BROWN					100% SAMPLE
-22	22	BROWN.					
-23	23						
-24	24						
-25	25						

Drafted ~~1/9/2012~~ 1/11/12

 WINZLER & KELLY

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 PROJECT NAME: TRINIDAD AS BS BORING NUMBER: SB-8

DATE BEGAN: 1/11/12

DRILLER: CLEARHEART DATE FINISHED: 1/11/12 FIELD GEOLOGIST: R. CRAWFORD

C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA STABLE DEPTH TO GW: 45.5' INITIAL DEPTH TO GW: 45.5'

DRILLING METHOD: HSA DRILLING EQUIP: 5', 2' SAMPLER TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25 to -30	25–30	SAME AS ABOVE STRONG 3/4" THICK OXIDIZED LAYER FEW COARSE GRAVEL, UP TO 2" DIA.		DRY	LOOSE	SW		100% SAMPLE
-30 to -35	30–35	POORLY GRADED SAND (1,99,0) FINE SAND, LIGHT GRAYISH BROWN.	10YR 6/2	DRY	MED. DENSE	SP		90% SAMPLE
-35 to -40	35–40	COLOR CHANGE TO GRAYISH BROWN	10YR 5/2				11 14 14 15	2' SAMPLER 100%
-40 to -45	40–45	WELL GRADED SAND (1,99,0) FINE TO MEDIUM SAND, GRAYISH BROWN.	10YR 5/2	MOIST	MED. DENSE	SW	13 17 39 31	100% SAMPLE
-45 to -48	45–48			WET	DENSE	▽	15 14 15 32	100% SAMPLE
-48 to -50	48–50	WEATHERED BEDROCK MUDSTONE BEDROCK 50' BGS					52	

BOH = 50.5 1/11/12 1305

Drafted ~~1/9/2012~~ 1/11/12

WINZLER & KELLY

SOIL BORING AND WELL LOG

PROJECT NO: 010631005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-9

DATE BEGAN: 1/12/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/12/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** ~38' ▼ **INITIAL DEPTH TO GW:** 39' ▽
DRILLING METHOD: HSA **DRILLING EQUIP:** 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	Blows	WELL CONSTRUCTION
0	0	✓ GRASS GRAVEL/SAND/SILT FILL				GW		HAND AUGER TO 5' BGS
-2	2	SILT WITH SAND (85,15,0) FINE SAND DARK YELLOWISH BROWN, NON-PLASTIC.	10YR 4/6	MOIST	FIRM	ML		
-3	3	SILTY SAND (20,80,0) FINE SAND LIGHT YELLOWISH BROWN	10YR 6/4	MOIST	LOOSE	SM		
-5	5	MOTTLING AT 5'-12'						
-6	6	POORLY GRADED SAND WITH SILT (10,90,0) FINE SAND, LIGHT YELLOWISH BROWN				SP		DRILL TO 10' BGS
-10	10	WOODY DEBRIS/ROOTS					2 3 3 4	SAMPLE 80%
-15	15							DRILL TO 20' BGS
-17	17	RIG RATTLED AT 17.5' WELL GRADED GRAVEL WITH SILT AND SAND (10,35,55) WELL ROUNDED FINE TO COARSE GRAVEL UP TO 1" DIA., FINE TO COARSE SAND, LIGHT BROWNISH GRAY.	10YR 6/2	DRY	LOOSE	GW-GM		
-21	21		10YR 2/2			PALEOSOL	4 6 11 12	SAMPLE 80%
-22	22	WELL GRADED SAND (5,95,0) FINE TO COARSE SAND, LIGHT BROWNISH GRAY. ABRUPT OVERLYING CONTACT 2" THICK, VERY DARK BROWN ORGANIC LAYER, SAND SUBROUNDED TO SUBANGULAR.	10YR 6/2	DRY	LOOSE	SW		

SOIL BORING AND WELL LOG

PROJECT NO: 010631005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-9
DATE BEGAN: 1/12/12
DRILLER: CLEARHEART DATE FINISHED: 1/12/12 FIELD GEOLOGIST: R.CRAWFORD
C57 License #: 780352 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA
SURFACE ELEVATION: NA STABLE DEPTH TO GW: 38 ▼ INITIAL DEPTH TO GW: 39 ▽
DRILLING METHOD: HSA DRILLING EQUIP: 5,2' SAMPLER TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	Blows	WELL CONSTRUCTION
-25	25	CONT. SW				SW	↓	DRILL TO 30' BGS
-30	30			DRY	LOOSE		7 7 8 10	
-34	34	SAME AS ABOVE, PARTIALLY CEMENTED (SILICIOUS?) ZONE 35'-40.5' BGS.						
-35	35		SAME	DRY	VERY DENSE		50	10% SAMPLE
-38	38				▼			
-39	39			WET	▽			
-41	41	40.5 SILTSTONE BEDROCK 1/12/12 BOH=40.5' 1130						

Depth scale: -25 to -50 ft.

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-10

DATE BEGAN: 1/11/12

DRILLER: CLEARHEART DATE FINISHED: 1/12/12 FIELD GEOLOGIST: R.CRAWFORD

C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA STABLE DEPTH TO GW: 40.25' INITIAL DEPTH TO GW: 38'

DRILLING METHOD: HSA DRILLING EQUIP: 2' SAMPLER TOC ELEVATION: NA

DEPTH (ft.)	SOIL DESCRIPTION (ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.)	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0	GRASS						
0–1	GRAVEL/SAND/SILT FILL		MOIST	LOOSE	GW		HAND AUGER, TO 5' BGS
1.5–4	SILT WITH SAND (85,15,0) FINE SAND, NON-PLASTIC, DARK YELLOW BROWN. GRADATIONAL CONTACT	10YR 4/6	MOIST	FIRM	ML		
4–5	SILTY SAND (20,80,0) FINE SAND LIGHT YELLOWISH BROWN	10YR 6/4	MOIST	LOOSE	SM		
5–12	POORLY GRADED SAND WITH SILT (10,90,0) FINE SAND, LIGHT YELLOWISH BROWN, ORANGE OXIDIZED LAYER AND MOTTLING 7-12', AT 12' ABRUPT CHANGE IN COLOR (DARK YELLOWISH BROWN) MARKED BY STRONG 1/2" OXIDIZED LAYER AT 12'.	10YR 4/6	DRY	LOOSE	SP-SM	3 3 4 5	SAMPLE 100%
10–11.5						4 4 4 5	SAMPLE 100%
12–15	POORLY GRADED SAND (5,95,0) FINE SAND, PALE BROWN.	10YR 4/6 / 10YR 6/3	DRY / DRY	LOOSE / LOOSE	SP		
15–20							DRILL TO 20' BGS
20–21.5	RIG RATTLED AT 23' DISCRETE CONTACT					10 12 17 16	SAMPLE 100%
23–25	SILT (99,1,0) FINE SAND, GRAYISH BROWN, LOW PLASTICITY.	10YR 5/2	DRY		ML		

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-10

DATE BEGAN: 1/11/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/12/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 40.25' **INITIAL DEPTH TO GW:** 38'

DRILLING METHOD: HSA **DRILLING EQUIP:** 5', 2' SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	Blows	WELL CONSTRUCTION
-25	25	DISCRET CONTACT AT 26'				ML	7	SAMPLE 80%
-26	26	POORLY GRADED SAND (1,99,0) FINE SAND, LIGHT BROWNISH GRAY.	10YR 6/2	DRY	MED. DENSE	SP	13 17 21	
-27	27							
-28	28							
-29	29							
-30	30						11	SAMPLE 90%
-31	31	STRONG OXIDIZED LAYER AT 31' ½" THICK.					15 21 32	
-32	32							
-33	33							
-34	34							
-35	35							DRILL TO 40' BGS
-36	36							
-37	37							
-38	38	SAND COARSENING		WET		▽		
-39	39	GRADATIONAL CONTACT						
-40	40					▼	7	
-41	41	WELL GRADED SAND (5,95,0) FINE TO COARSE SAND, SUB-ROUNDED TO SUB-ANGULAR.	SAME	WET	MED-DENSE	SW	11 14 21	
-43	43	RIG RATTLED HARD AT 43' SANDSTONE/GRAYWACKE BEDROCK					50+	
-45	45							
-46	46	BOH = 43.5 1/12/12						
-47	47							
-48	48							
-49	49							
-50	50							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-11

DATE BEGAN: 1/19/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/19/12 **FIELD GEOLOGIST:** R CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 49' **INITIAL DEPTH TO GW:** 49'

DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0	0	ASPHALT 3"						HAND AUGER TO 5' BGS
-1	1	GRAVEL/SAND/SILT FILL TO 3' BGS				GW		
-3	3	SILTY SAND (15,85,0) FINE SAND, LIGHT YELLOWISH BROWN.	10YR 6/4	DRY	LOOSE	SM		
-5	5							DRILL TO 10' BGS
-9	9	POORLY GRADED SAND (5,95,0) FINE SAND, LIGHT YELLOWISH BROWN. STRONG OXIDIZED ½" LAYERS @ 10.5' & 11.5'	10YR 6/4	DRY	LOOSE	SP	5 7 7 11	SAMPLE 100%
-14	14	WELL GRADED GRAVEL WITH SAND (5,15,85) FINE TO COARSE SAND, SUBROUNDED GRAVEL UP TO 1" DIAMETER	SAME	DRY	LOOSE	GW		
-15	15	POORLY GRADED SAND (5,95,0) FINE SAND.	SAME	DRY	LOOSE	SP		DRILL TO 20' BGS
-18	18	6" SILT LAYER				ML		
						SP		
-19	19	WELL GRADED SAND (5,95,0) FINE TO COARSE SUBROUNDED TO SUBANGULAR SAND, PALE BROWN.	10YR 6/3	DRY	LOOSE-MED-DENSE	SW	7 11 13 19	SAMPLE 100%
-25	25							

Drafted ~~1/9/2012~~ 1/19/12

 WINZLER & KELLY

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-11
DATE BEGAN: 1/19/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/19/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 49' **INITIAL DEPTH TO GW:** 49'
DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-25 to -30	25–30	CONT. SW	SAME	DRY		SW	DRILL TO 30' BGS
-30 to -35	30–35	SAND FINING AT DEPTH					7 / 9 / 11 / 10 SAMPLE 100%
-35 to -40	35–40	POORLY GRADED SAND (5,95,0) FINE SAND, LIGHT YELLOWISH BROWN				SP (from 38')	DRILL TO 40' BGS * RIG RATTLED @ 38' BGS, SO ASSUME STRAT CHANGE
-40 to -45	40–45						12 / 17 / 19 / 23
-45 to -50	45–50					▼ (49')	DRILL TO 50' BGS

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-11
DATE BEGAN: 1/19/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/19/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 49' **INITIAL DEPTH TO GW:** 49'
DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-50	50	CONT. SP	SAME	DRY	MED DENSE	SP	13	
-51	51						15	
-52	52						21	
-53	53						26	
-54	54							
-55	55							DRILL TO 60' BGS
-56	56							
-57	57							
-58	58	WELL GRADED SAND (5,95,0) FINE TO COARSE SUBROUNDED TO SUBANGULAR SAND, BROWN. STRONG OXIDIZED LAYER FROM 59-61' AS BRIGHT ORANGE/RED.	10YR 5/3	WET	LOOSE	SW		
-59	59							
-60	60						10	
-61	61						11	
-62	62						14	
-63	63						17	
-64	64	BOH = 63' 1/19/12 1105 SANDSTONE				BEDROCK		
-65	65							
-66	66							
-67	67							
-68	68							
-69	69							
-70	70							
-71	71							
-72	72							
-73	73							
-74	74							
-75	75							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-12
DATE BEGAN: 1/10/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/10/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 48' **INITIAL DEPTH TO GW:** 48'
DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER 8" AUGERS **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0 to -2	0–2	GRAVEL FILL TO 2' BGS				GW		HAND AUGER TO 5' BGS
-2 to -5	2–5	SANDY SILT (60,40,0) FINE SAND, LOW PLASTICITY, DARK YELLOWISH BROWN.	10YR 4/6	MOIST	FIRM	ML		
-5 to -10	5–10	SILTY SAND (15,85,0) FINE SAND LIGHT YELLOWISH BROWN	10YR 6/4	MOIST	LOOSE	SM		DRILL TO 10' BGS
	9–10	POORLY GRADED SAND (5,95,0) FINE SAND, LIGHT YELLOWISH BROWN.	10YR 6/4	MOIST	LOOSE	SP		
-10 to -13	10–13						11 6 9 13	SAMPLE 90%
-13 to -15	13–15	WELL GRADED GRAVEL WITH SAND (5,25,70) FINE TO COARSE SAND, FINE ROUNDED GRAVEL UP TO 3/4", GRAY.	10YR 6/1	MOIST	LOOSE	GW		
-15 to -17	15–17	POORLY GRADED SAND (5,95,0) FINE SAND, PALE BROWN.	10YR 6/3	DRY	FIRM	SP		DRILL TO 20' BGS
-17 to -19	17–19	SILT WITH SAND (80,20,0) LOW PLASTICITY, PALE BROWN				ML		
-19 to -25	19–25	WELL GRADED SAND (1,99,0) FINE TO MEDIUM, SUBROUND TO SUBANGULAR SAND, FEW COARSE SAND, PALE BROWN COARSENING AT DEPTH	10YR 6/3	DRY	LOOSE	SW	6 9 10 12	SAMPLE 60%

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 PROJECT NAME: TRINIDAD ABBS BORING NUMBER: SB-12
DATE BEGAN: 1/10/12
DRILLER: CLEARHEART DATE FINISHED: 1/10/12 FIELD GEOLOGIST: R. CRAWFORD
C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA
SURFACE ELEVATION: NA STABLE DEPTH TO GW: 48' INITIAL DEPTH TO GW: 48'
DRILLING METHOD: HSA DRILLING EQUIP: 2' CORE SAMPLER 8" AUGERS TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25	25	CONT. SW				SW		DRILL TO 30' BGS
-29	29	FINE TO COARSE SAND	SAME	DRY	MED-DENSE			
-30	30						10, 9, 9, 12	SAMPLE 100%
-35	35		SAME	SAME	SAME		6, 9, 13, 15	SAMPLE 100%
-40	40		SAME	SAME	SAME			DRILL TO 45' BGS
-43	43	POORLY GRADED SAND (1,99,0) FINE SAND, BROWN. ORANGE	10YR5/3	DRY	MED. DENSE	SP		
-45	45	MOTTLING 45-47'. STRONG OXIDIZED LAYER AT 46.5' (IDENTICLE TO THAT OF SB-7)					14, 19, 21, 32	SAMPLE 100%
-47	47			WET		▼ (48')		
-50	50							

SOIL BORING AND WELL LOG

PROJECT NO: 010631005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-12

DATE BEGAN: 1/10/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/10/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 48' **INITIAL DEPTH TO GW:** 48'

DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER 8" AUGERS **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	← BLOWS	WELL CONSTRUCTION
-50	50	CONT. SP	SAME	WET	SAME	SP		DRILL TO 55' BGS
-51	51							
-52	52							
-53	53							
-54	54	WELL GRADED SAND (5,95,0)	10YR 5/3	WET	DENSE TO VERY DENSE	SW		
-55	55	FINE TO COARSE, SUBROUNDED TO					13	
-56	56	SUBANGULAR SAND, BROWN.					29	
-57	57						30 32	
-58	58							
-59	59							
-60	60						10	
-61	61						11 13	
-62	62	SANDSTONE BEDROCK						
-63	63	DISCRETE CONTACT WITH						
-64	64	RED OXIDATION						
-65	65							
-66	66	BOH = 61.5' BGS						
-67	67	1/10/12						
-68	68	1530						
-69	69							
-70	70							
-71	71							
-72	72							
-73	73							
-74	74							
-75	75							

SOIL BORING AND WELL LOG

PROJECT NO: 010631100S **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-13
DATE BEGAN: 1/20/12
DRILLER: CLEARHEART **DATE FINISHED:** 1/20/12 **FIELD GEOLOGIST:** R. CRAWFORD
C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA
SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 30' **INITIAL DEPTH TO GW:** 30'
DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER 8" AUGERS **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0	0	ASPHALT 4" GRAVEL/SAND/SILT FILL TO 4.5' BGS				GW		HAND AUGER TO 5' BGS
-5	5	POORLY GRADED SAND (1,99,0) FINE SAND, LIGHT BROWNISH GRAY	10YR 6/2	DRY	LOOSE	SP		DRILL TO 10' BGS
-10	10	ORANGE MOTTLING 10.5-11.5' BGS	SAME	SAME	SAME		5, 7, 11, 17	SAMPLE 100%
-15	15		SAME	SAME	SAME			DRILL TO 20' BGS
-20	20	COLOR CHANGE TO LIGHT YELLOWISH BROWN	10YR 6/4	MOIST	LOOSE		7, 7, 10, 15	SAMPLE 100%
-25	25							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ASBS **BORING NUMBER:** SB-13

DATE BEGAN: 1/20/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/20/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** 30' **INITIAL DEPTH TO GW:** 30'

DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER 8" AUGERS **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
-25 to -27	25–27	CONT. SP				SP		DRILL TO 30' BGS
-27 to -30	27–30	WELL GRADED SAND WITH SILT (10,90,0) FINE TO COARSE, SUB-ROUNDED TO SUBANGULAR SAND, DARK YELLOWISH BROWN.	10YR 4/6	MOIST	LOOSE	SW-SM (GW ▼ at 30)		
-30 to -35	30–35	BLACK OXIDIZED 1/4" LAYER AT 31' BGS					7, 11, 13, 17	SAMPLE 100%
-35 to -39.5	35–39.5		SAME	WET	LOOSE		50	DRILL TO 39'
-40 to -45	40–45	HIGHLY SHEARED SILTSTONE BEDROCK @ 39.5' BOH = 39.5' 1/20/12 1045						
-45 to -50	45–50							

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-14
DATE BEGAN: 1/23/12
DRILLER: CLEARHEART DATE FINISHED: 1/23/12 FIELD GEOLOGIST: R. CRAWFORD
C57 License #: 780357 NORTHING/LATITUDE: EASTING/LONGITUDE:
SURFACE ELEVATION: NA STABLE DEPTH TO GW: NA INITIAL DEPTH TO GW: NA
DRILLING METHOD: HSA DRILLING EQUIP: 2' CORE SAMPLER 8" AUGERS TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0	0	ASPHALT 4"						
-1	1	GRAVEL/SAND/SILT FILL TO 3.5' BGS				GW		HAND AUGER TO 5' BGS
-4	4	WELL GRADED SAND (1,99,0) FINE TO COARSE SUBROUNDED TO SUBANGULAR SAND, PALE BROWN.	10YR 6/3	DRY	LOOSE	SW		
-5	5							DRILL TO 10
-10	10			MOIST				
-11	11	HIGHLY SHEARED SILTSTONE BED ROCK		DRY			7 21 27 30	SAMPLE 100%
-15	15							DRILL TO 20' BGS
-20	20						11 17 22 24	
-23	23	BOH = 22' 1/23/12 1515						
-25	25							

Drafted ~~1/9/2012~~ 1/23/12

 WINZLER & KELLY

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 **PROJECT NAME:** TRINIDAD ABBS **BORING NUMBER:** SB-15

DATE BEGAN: 1/23/12

DRILLER: CLEARHEART **DATE FINISHED:** 1/23/12 **FIELD GEOLOGIST:** R. CRAWFORD

C57 License #: 780357 **NORTHING/LATITUDE:** NA **EASTING/LONGITUDE:** NA

SURFACE ELEVATION: NA **STABLE DEPTH TO GW:** NA **INITIAL DEPTH TO GW:** NA

DRILLING METHOD: HSA **DRILLING EQUIP:** 2' CORE SAMPLER **TOC ELEVATION:** NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0	0	ASPHALT 4"						
-1	1	GRAVEL/SAND/SILT FILL TO 3.5' BGS.				GW		HAND AUGER TO 5' BGS
-2	2							
-3	3							
-4	4	SILT WITH SAND (75,25,0) FINE SAND, LOW PLASTICITY, YELLOWISH BROWN.	10YR5/6	DRY	SOFT	ML		
-5	5							
-6	6	SILTY SAND (15,85,0) FINE SAND, LIGHT YELLOWISH BROWN.	10YR6/4	DRY	LOOSE	SM		DRILL TO 10' BGS
-7	7							
-8	8							
-9	9							
-10	10						2	SAMPLE 100%
-11	11	ORANGE MOTTLING AT 11' BGS	SAME	DRY	LOOSE		2	
-12	12						3	
-13	13	FINE, ROUNDED, GRAVEL LAYER (2")					5	
-14	14							
-15	15							DRILL TO 20' BGS
-16	16							
-17	17							
-18	18							
-19	19							
-20	20	COLOR CHANGE TO PALE BROWN	10YR6/3	DRY	LOOSE		4	
-21	21						5	
-22	22						5	
-23	23						6	
-24	24	SANDSTONE BEDROCK BOH = 23'				BEDROCK	50 BLOWS FOR 5"	
-25	25							

SOIL BORING AND WELL LOG

PROJECT NO: 010631l005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-16
DATE BEGAN: 1/18/12
DRILLER: CLEARHEART DATE FINISHED: 1/18/12 FIELD GEOLOGIST: R. CRAWFORD
C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA
SURFACE ELEVATION: NA STABLE DEPTH TO GW: 15.5' INITIAL DEPTH TO GW: 15.5'
DRILLING METHOD: HSA DRILLING EQUIP: 5' CORE BARREL 2' CORE SAMPLER TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	BLOWS	WELL CONSTRUCTION
0 to -3	0–3	ASPHALT 3" GRAVEL/SAND/SILT FILL TO 3' BGS	–	MOIST	LOOSE	GW		HAND AUGER TO 5' BGS
-3 to -10	3–10	WELL GRADED SAND (1,99,0) FINE TO MEDIUM SAND, LIGHT BROWNISH GRAY.	10YR 6/2	MOIST	LOOSE	SW		DRILL TO 10' BGS
-10 to -13	10–13	SILT (99,1,0) TRACE FINE SAND, LOW PLASTICITY, DARK BROWN. DISCRETE CONTACT WITH OVERLYING SAND, CHARCOAL.	10YR 3/3	MOIST	SOFT-FIRM	ML	4 5 5 6	SAMPLE 100% FOR 2'
-13 to -18	13–18	POORLY GRADED SAND (1,99,0) FINE SAND, LIGHT BROWNISH GRAY.	10YR 6/2	MOIST / WET (15.5')	LOOSE	SP ▼	5 7 9 11	SAMPLE 100% FOR 2' / DRILL TO 20' BGS
-18 to -25	18–25	WELL GRADED SAND (5,95,0) FINE TO COARSE, SUBROUNDED TO SUBANGULAR SAND, LIGHT BROWNISH GRAY MATRIX SILT IS BRIGHT ORANGE	10YR 6/2	WET	LOOSE	SW	5 6 5 7	SAMPLE 100%

SOIL BORING AND WELL LOG

PROJECT NO: 0106311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-16

DATE BEGAN: 1/18/12

DRILLER: CLEARHEART DATE FINISHED: 1/18/12 FIELD GEOLOGIST: R. CRAWFORD

C57 License #: 780357 NORTHING/LATITUDE: NA EASTING/LONGITUDE: NA

SURFACE ELEVATION: NA STABLE DEPTH TO GW: 15.5 INITIAL DEPTH TO GW: 15.5

DRILLING METHOD: HSA DRILLING EQUIP: 2' AND 5' CORE SAMPLERS TOC ELEVATION: NA

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-25	25	CONT. SW	SAME	SAME	SAME	SW	DRILL TO 29' BGS
-26	26						
-27	27						
-28	28						
-29	29	SANDSTONE BEDROCK					
-30	30	BOH = 29' 1/18/12 1415					
-31	31						
-32	32						
-33	33						
-34	34						
-35	35						
-36	36						
-37	37						
-38	38						
-39	39						
-40	40						
-41	41						
-42	42						
-43	43						
-44	44						
-45	45						
-46	46						
-47	47						
-48	48						
-49	49						
-50	50						

SOIL BORING AND WELL LOG

PROJECT NO: 01010311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-17
DATE BEGAN: 1/24/12 BY R. CRAWFORD (GHD)
DRILLER: CLEARHEART DATE FINISHED: 2/1/2012 FIELD GEOLOGIST: A. GOWER
C57 License #: 780359 NORTHING/LATITUDE: NOT SURVEYED EASTING/LONGITUDE: NOT SURVEYED
SURFACE ELEVATION: STABLE DEPTH TO GW: N/A INITIAL DEPTH TO GW: 45' bgs
DRILLING METHOD: HOLLOW STEM AUGER DRILLING EQUIP: 2' SAMPLER TOC ELEVATION:

*TOOK OVER LOGGING SOILS/OVERSIGHT FOR R. CRAWFORD. CONTINUED DRILLING AT 25' bgs ON 2/1/12

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-25 to -30	25–30	POORLY GRADED SAND (5,95,0), FINE-GRAINED SAND, LIGHT BROWN GRAY	10YR 6/2	MOIST	LOOSE	SP 10, 10, 12, 13 BLOW COUNTS	SAMPLE FROM 25' TO 27' bgs RECOVERY = 90% DRILL TO 30' bgs
-30 to -35	30–35	SILTY SAND (20,80,0), FINE GRAINED SAND, LIGHT BROWN GRAY MOTTLING (5YR 3/3, DARK REDDISH BROWN) ↓ SLIGHTLY COARSER	10YR 6/2	MOIST	LOOSE ↓ MEDIUM DENSE	SM 10, 10, 12, 13	SAMPLE 30'-32' bgs RECOVERY = 90% DRILL TO 35' bgs
-35 to -40	35–40	POORLY GRADED SAND (5,95,0), FINE GRAINED SAND, LIGHT BROWN GRAY COARSENS ~ 39'-39.5' bgs	10YR 6/2	MOIST	LOOSE	SP 4, 6, 8, 8	SAMPLE 35'-37' bgs RECOVERY = 80% DRILL TO 40' bgs
-40 to -45	40–45	WELL-GRADED SAND (10,90,0) FINE TO MEDIUM GRAINED SAND, LIGHT YELLOW BROWN	10YR 6/4	DRY	MEDIUM DENSE	SW 8, 11, 15, 21	SAMPLE 40'-42' bgs RECOVERY = 90% DRILL TO 45' bgs
-45 to -50	45–50	▽ WELL GRADED SAND (5,90,5), FINE TO COARSE SAND, SUBROUNDED, <3/8" GRAVEL	10YR 3/3	WET → SATURATED	LOOSE	SW 10, 8, 8, 7	SAMPLE 45'-47' bgs RECOVERY = 30% DRILL TO 50' bgs

SOIL BORING AND WELL LOG

PROJECT NO: 01010311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-17
DATE BEGAN: 1/24/2012
DRILLER: CLEAR HEART DATE FINISHED: 2/1/2012 FIELD GEOLOGIST: A GOWER
C57 License #: 780351 NORTHING/LATITUDE: NOT SURVEYED EASTING/LONGITUDE: NOT SURVEYED
SURFACE ELEVATION: STABLE DEPTH TO GW: 45.9 ▽ INITIAL DEPTH TO GW: 45' bgs ▽
DRILLING METHOD: HSA DRILLING EQUIP: 2' SAMPLER TOC ELEVATION:

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-50 to -55	50 to 55	WELL GRADED SAND (0, 90, 10) fine to coarse sand, subround, <3/8" gravel, dark brown BEDROCK ENCOUNTERED AT 51' bgs. TOTAL DEPTH OF SB-17 = 51.5' bgs	10YR 3/3	MOIST	LOOSE	SW 22 10 50	SAMPLE 50'-52' bgs RECOVERY = 10%
-55 to -60	55 to 60						
-60 to -65	60 to 65						
-65 to -70	65 to 70						
-70 to -75	70 to 75						

Drafted 1/9/2012

WINZLER & KELLY

SOIL BORING AND WELL LOG

PROJECT NO: 01010311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-18
DATE BEGAN: 2/1/2012
DRILLER: CLEARHEART DATE FINISHED: 2/2/2012 FIELD GEOLOGIST: A GOWER
C57 License #: 780357 NORTHING/LATITUDE: NOT SURVEYED EASTING/LONGITUDE: NOT SURVEYED

SURFACE ELEVATION: STABLE DEPTH TO GW: 58.4' bgs INITIAL DEPTH TO GW: 58' bgs
DRILLING METHOD: HSA DRILLING EQUIP: 2' SAMPLER TOC ELEVATION:

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
0 to -5	0–5	ASPHALT ~4" SILT/GRAVEL/SAND FILL (35,50,15), FINE SAND, VERY DARK BROWN SILTY SAND (15,85,0), FINE SAND, VERY DARK BROWN COLOR CHANGE TO 10YR 5/6 (YELLOWISH BROWN) AT APPROX. 4' bgs	10YR 2/2 10YR 2/2	MOIST MOIST	LOOSE LOOSE	GW SM	HAND AUGER FROM APPROXIMATELY 0.5' TO 5' bgs
-5 to -10	5–10	YELLOW BROWN	10YR 5/6	MOIST	LOOSE	3 2 2 2	SAMPLES 5'-7' bgs RECOVERY = 90% → BLOW COUNTS DRILL TO 10' bgs
-10 to -15	10–15	DARK BROWN MOTTLING AT 11' bgs (5YR 3/3, DARK REDDISH BROWN) GRAVEL LENS AT APPROXIMATELY 13.5'-14.25' bgs	10YR 3/3	MOIST	LOOSE	3 2 3 3	SAMPLE 10'-12' bgs RECOVERY = 75% DRILL TO 15' bgs
-15 to -20	15–20	POORLY GRADED SAND (5,95,0) FINE SAND, LIGHT YELLOWISH BROWN MOTTLING AT 16' bgs (5YR 3/3, DARK REDDISH BROWN)	2.5Y 6/4	MOIST	LOOSE ↓ MEDIUM DENSE	SP 8 9 7 8	SAMPLE 15'-17' bgs RECOVERY = 90% DRILL TO 20' bgs
-20 to -25	20–25	LIGHT BROWNISH GRAY COARSENS FROM ~23'-24.5' bgs	10YR 6/2	MOIST	MEDIUM DENSE	10 10 12 14	SAMPLE 20'-22' bgs RECOVERY = 90% DRILL TO 25' bgs

SOIL BORING AND WELL LOG

PROJECT NO: 010623110S PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-18
DATE BEGAN: 2/1/2012
DRILLER: CLEARHEART DATE FINISHED: 2/2/2012 FIELD GEOLOGIST: A GOWER
C57 License #: 780357 NORTHING/LATITUDE: NOT SURVEYED EASTING/LONGITUDE: NOT SURVEYED

SURFACE ELEVATION: STABLE DEPTH TO GW: 58.4' bgs ▼ INITIAL DEPTH TO GW: 58' bgs
DRILLING METHOD: HSA DRILLING EQUIP: 2' SAMPLER *SWITCHED TO 18" ON 2/2/2012 TOC ELEVATION:

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-25 to -30	25–30	LIGHT BROWNISH GRAY COARSENS @ 28.25'; NO COLOR CHANGE	10YR 6/2	DRY → MOIST	MEDIUM DENSE TO DENSE	SP 11 10 23 30	SAMPLE 25'-27' bgs RECOVERY = 80% DRILL TO 30' bgs
-30 to -35	30–35	*SOME COARSER-GRAINED SLOUGH AT TOP OF SAMPLER.		DRY → MOIST	MEDIUM DENSE	21 21 17	SAMPLE 30'-32' bgs RECOVERY = 90% DRILL TO 35' bgs *DRILL RIG BROKE DOWN. HALT @ 35' bgs ON 2/1/2012
-35 to -40	35–40	POORLY GRADED SAND (10, 90, 0) FINE GRAINED SAND, BROWN	10YR 4/3	MOIST	LOOSE → MEDIUM DENSE	SP 6 8 10	*2/2/2012 RESUME DRILLING WITH A NEW RIG. 18" SAMPLER SAMPLE 35'-36.5' bgs DRILL TO 40' bgs
-40 to -45	40–45	POORLY GRADED SAND (5, 95, 0), FINE GRAINED SAND, BROWN	10YR 4/3	DRY → MOIST	LOOSE	11 9 9	SAMPLE 40'-41.5' bgs RECOVERY = 80% DRILL TO 45' bgs
-45 to -50	45–50			DRY → MOIST	LOOSE → MEDIUM DENSE	10 9 12	SAMPLE 45'-46.5' bgs RECOVERY = 75% DRILL TO 50' bgs

SOIL BORING AND WELL LOG

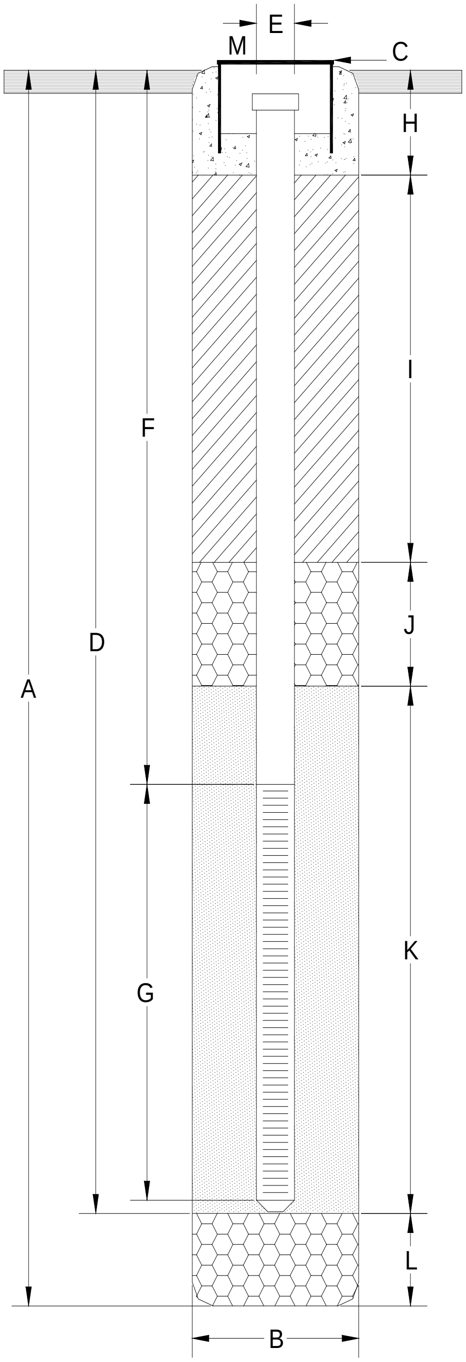
PROJECT NO: 01000311005 PROJECT NAME: TRINIDAD ASBS BORING NUMBER: SB-18
DATE BEGAN: 2/1/2012
DRILLER: CLEARHEART DATE FINISHED: 2/2/2012 FIELD GEOLOGIST: A GOWER
C57 License #: 780357 NORTHING/LATITUDE: NOT SURVEYED EASTING/LONGITUDE: NOT SURVEYED

SURFACE ELEVATION: STABLE DEPTH TO GW: 58.4' bgs ▼ INITIAL DEPTH TO GW: 58' bgs
DRILLING METHOD: HSA DRILLING EQUIP: 18" SAMPLER TOC ELEVATION:

ELEVATION (ft.-msl)	DEPTH (ft.)	SOIL DESCRIPTION ASTM Soil Name - Percentages (0,0,0), fines, sand, gravel; grain size, plasticity, roundness, interpretation; other.	COLOR (MUNSELL)	MOISTURE	CONSISTENCY	SOIL PROFILE	WELL CONSTRUCTION
-50	50	POORLY GRADED SAND (10,90,0) FINE GRAINED SAND, LIGHT OLIVE BROWN	2.5Y 5/3	DRY → SLIGHTLY MOIST	MEDIUM DENSE	SP 10 12 14	SAMPLE 50'-51.5' bgs RECOVERY = 90% DRILL TO 55' bgs
-51	51						
-52	52						
-53	53						
-54	54						
-55	55	POORLY GRADED SAND (5,95,0), FINE GRAINED SAND, LIGHT OLIVE BROWN SATURATED AT 58' bgs	2.5Y 5/3	MOIST	LOOSE	SP 8 10 12	SAMPLE 55'-56.5' bgs RECOVERY = 60% DRILL TO 60' bgs
-56	56						
-57	57						
-58	58					▽	
-59	59						
-60	60	WELL GRADED SAND (5,95,0) FINE TO COARSE SAND, SUBROUND TO SUBANGULAR, LIGHT OLIVE BROWN	2.5Y 5/3	SATURATED	MEDIUM DENSE	SW 9 10 14	SAMPLE 60'-61.5' bgs RECOVERY = 70% DRILL TO 65' bgs
-61	61						
-62	62						
-63	63						
-64	64						
-65	65	66'-66.5' SILTY SAND, (20,80,0) FINE SAND, DUSKY RED	10R 3/3			50 for 3" SM	SAMPLE 65'-66.5' bgs RECOVERY = 30% DRILL TO 70' bgs
-66	66						
-67	67						
-68	68						
-69	69						
-70	70	BEDROCK ENCOUNTERED AT 70' bgs TOTAL DEPTH OF SB18 = 70' bgs				50 for 3" 50 for 3"	SAMPLE 70'-71' bgs RECOVERY = 15%
-71	71						
-72	72						
-73	73						
-74	74						
-75	75						

Appendix D
Monitoring Well Construction Diagrams

MW-1 MONITORING WELL CONSTRUCTION DETAILS



A	Total Depth of Boring	29	ft.
B	Diameter of Boring	8	in.
	Drilling Method	hollow stem auger	
C	Top of Box Elevation	28.26	ft.
	☐ Referenced to Mean Sea Level		
	☒ Referenced to Project-Datum		
D	Casing Length	29	ft.
	Material	schedule 40 PVC	
E	Casing Diameter	2	in.
F	Depth to Top Perforations	19	ft.
G	Perforated Length	10	ft.
	Perforated interval from 19-29 ft bgs		
	Perforation Size	0.010	in.
H	Surface Seal from	0 to 1	ft.
	Seal Material	Concrete	
I	Backfill from	1 up to 14	ft.
	Seal Material	neat cement	
J	Seal will be a minimum of 2 ft thick		
	Seal Material	hydrated bentonite from 14-17 feet bgs	
K	Sand Pack minimum of 2 ft above screen to the bottom		
	Pack Material	Cemex # 2/12 sand from 17 to 29 feet bgs	
L	Bottom Seal	N/A	ft.
	Seal Material	N/A	
M	Traffic-rated, water-resistant, steel well box		
	Locking expandable well plug with lock		

Note: Depths measured from initial ground surface.

GHD

718 Third Street
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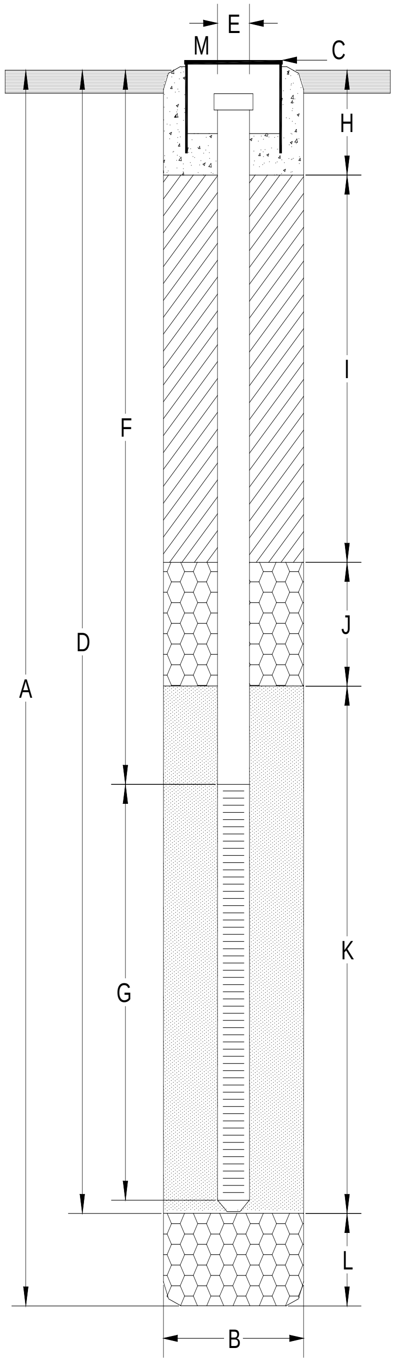
Well No.

City of Trinidad ASBS Project **MW-1**

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	18-Jan-12	**Monitoring Well Construction Details**

MW-2 MONITORING WELL CONSTRUCTION DETAILS



A	Total Depth of Boring	39	ft.
B	Diameter of Boring	8	in.
	Drilling Method	hollow stem auger	
C	Top of Box Elevation	93.46	ft.
	☐ Referenced to Mean Sea Level		
	☒ Referenced to Project-Datum		
D	Casing Length	39	ft.
	Material	schedule 40 PVC	
E	Casing Diameter	2	in.
F	Depth to Top Perforations	29	ft.
G	Perforated Length	10	ft.
	Perforated interval from 29-39 ft bgs		
	Perforation Size	0.010	in.
H	Surface Seal from	0 to 1	ft.
	Seal Material	concrete	
I	Backfill from	1 up to 24	ft.
	Seal Material	neat cement	
J	Seal will be a minimum of 2 ft thick		
	Seal Material	hydrated bentonite from 24 to 27 feet bgs	
K	Sand Pack minimum of 2 ft above screen to the bottom		
	Pack Material	Cemex # 2/12 sand from 27 to 39 feet bgs	
L	Bottom Seal	N/A	ft.
	Seal Material	N/A	
M	Traffic-rated, water-resistant, steel well box		
	Locking expandable well plug with lock		

Note: Depths measured from initial ground surface.

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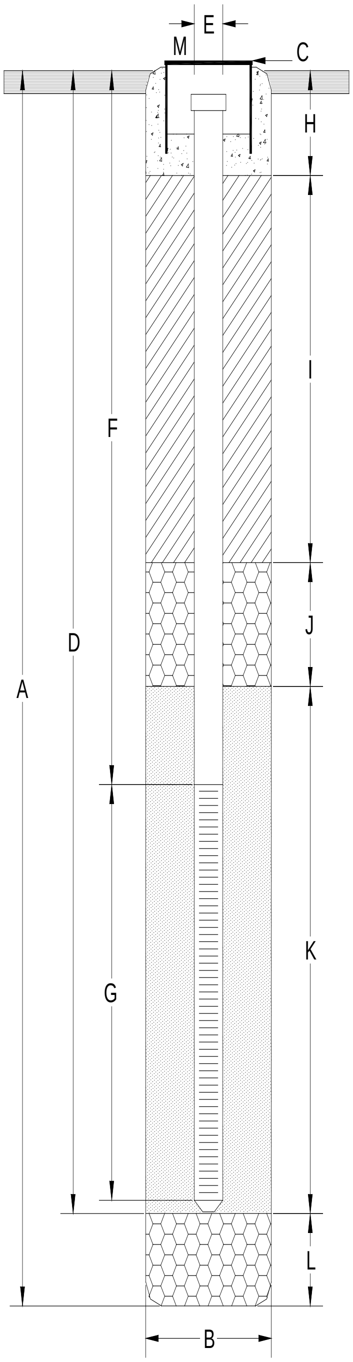
City of Trinidad ASBS Project

Well No.

MW-2

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	20-Jan-12	**Monitoring Well Construction Details**

MW-3 MONITORING WELL CONSTRUCTION DETAILS



A	Total Depth of Boring	51.5	ft.
B	Diameter of Boring	8	in.
	Drilling Method	hollow stem auger	
C	Top of Box Elevation	118.99	ft.
	☐ Referenced to Mean Sea Level		
	☒ Referenced to Project-Datum		
D	Casing Length	51.5	ft.
	Material	schedule 40 PVC	
E	Casing Diameter	2	in.
F	Depth to Top Perforations	41.5	ft.
G	Perforated Length	10	ft.
	Perforated interval from 41.5-51.5 ft bgs		
	Perforation Size	0.010	in.
H	Surface Seal from	0 to 1	ft.
	Seal Material	concrete	
I	Backfill from	1 up to 36.5	ft.
	Seal Material	neat cement	
J	Seal will be a minimum of 2 ft thick		
	Seal Material	hydrated bentonite from 36.5 to 39.5 feet bgs	
K	Sand Pack minimum of 2 ft above screen to the bottom		
	Pack Material	Cemex # 2/12 sand from 39.5 to 51.5 feet bgs	
L	Bottom Seal	N/A	ft.
	Seal Material	N/A	
M	Traffic-rated, water-resistant, steel well box		
	Locking expandable well plug with lock		

Note: Depths measured from initial ground surface.

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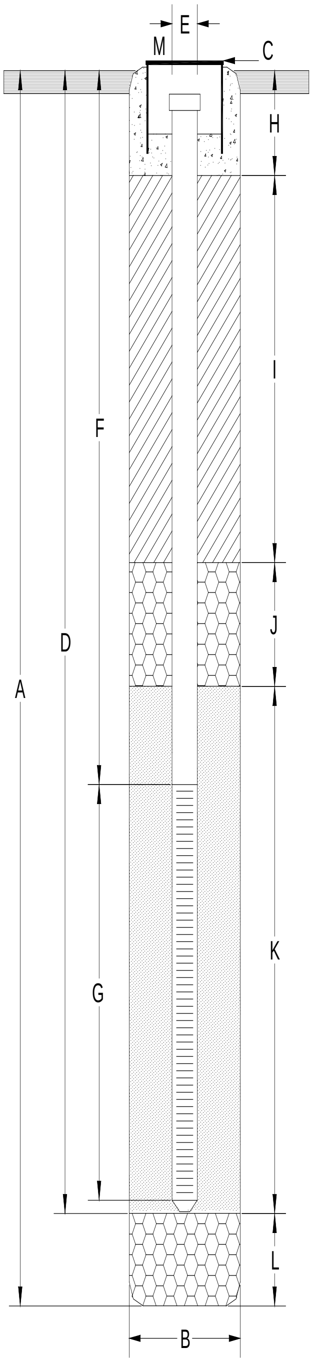
Well No.

City of Trinidad ASBS Project **MW-3**

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	1-Feb-12	**Monitoring Well Construction Details**

MW-4 MONITORING WELL CONSTRUCTION DETAILS



A Total Depth of Boring 39 ft.

B Diameter of Boring 8 in.
Drilling Method hollow stem auger

C Top of Box Elevation 170.98 ft.
☐ Referenced to Mean Sea Level
☒ Referenced to Project-Datum

D Casing Length 39 ft.
Material schedule 40 PVC

E Casing Diameter 2 in.

F Depth to Top Perforations 29 ft.

G Perforated Length 10 ft.
Perforated interval from 29-39 ft bgs
Perforation Size 0.010 in.

H Surface Seal from 0 to 1 ft.
Seal Material concrete

I Backfill from 1 up to 24 ft.
Seal Material neat cement

J Seal will be a minimum of 2 ft thick
Seal Material hydrated bentonite from 24-27 feet bgs

K Sand Pack minimum of 1 ft above screen to the bottom
Pack Material Cemex # 2/12 sand from 27 to 39 feet bgs

L Bottom Seal N/A ft.
Seal Material N/A

M Traffic-rated, water-resistant, steel well box
Locking expandable well plug with lock

Note: Depths measured from initial ground surface.

Well No.

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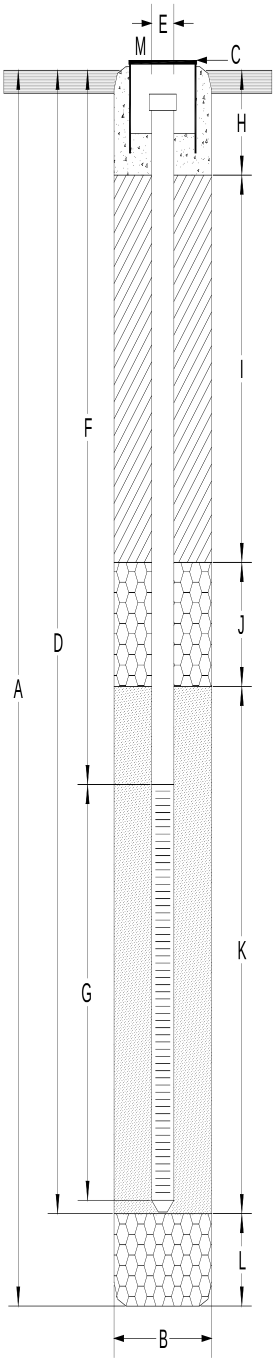
City of Trinidad ASBS Project **MW-4**

JOB NUMBER	REVIEWED E DATE	
106311005	P.Sullivan 12-Jan-12	**Monitoring Well Construction Details**

MW-5 MONITORING WELL CONSTRUCTION DETAILS



A	Total Depth of Boring	43	ft.
B	Diameter of Boring	8	in.
	Drilling Method	hollow stem auger	
C	Top of Box Elevation	171.62	ft.
	☐ Referenced to Mean Sea Level		
	☒ Referenced to Project-Datum		
D	Casing Length	43	ft.
	Material	schedule 40 PVC	
E	Casing Diameter	2	in.
F	Depth to Top Perforations	33	ft.
G	Perforated Length	10	ft.
	Perforated interval from 33-43 ft bgs		
	Perforation Size	0.010	in.
H	Surface Seal from	0 to 1	ft.
	Seal Material	concrete	
I	Backfill from	1 up to 22	ft.
	Seal Material	neat cement	
J	Seal will be a minimum of 2 ft thick		
	Seal Material	hydrated bentonite from 22-28 feet bgs	
K	Sand Pack minimum of 2 ft above screen to the bottom		
	Pack Material	Cemex # 2/12 sand from 28-43 feet bgs	
L	Bottom Seal	N/A	ft.
	Seal Material	N/A	
M	Traffic-rated, water-resistant, steel well box		
	Locking expandable well plug with lock		

Note: Depths measured from initial ground surface.

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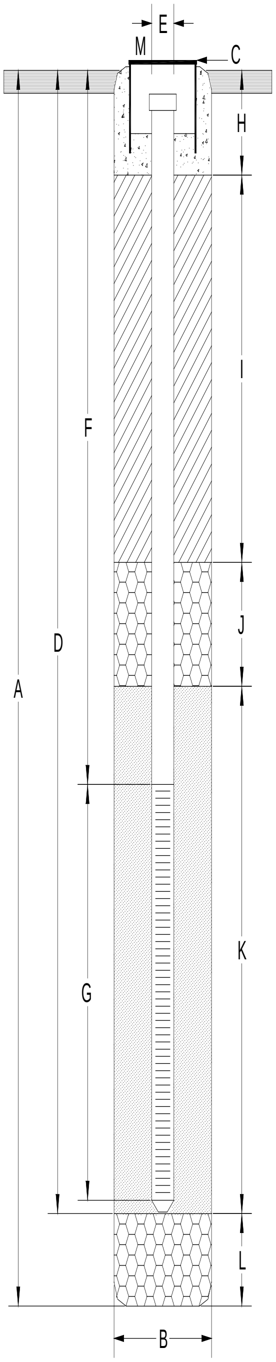
Well No.

City of Trinidad ASBS Project **MW-5**

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	12-Jan-12	**Monitoring Well Construction Details**

MW-6 MONITORING WELL CONSTRUCTION DETAILS



A	Total Depth of Boring	34	ft.
B	Diameter of Boring	8	in.
	Drilling Method	hollow stem auger	
C	Top of Box Elevation	152.73	ft.
	☐ Referenced to Mean Sea Level		
	☒ Referenced to Project-Datum		
D	Casing Length	34	ft.
	Material	schedule 40 PVC	
E	Casing Diameter	2	in.
F	Depth to Top Perforations	24	ft.
G	Perforated Length	10	ft.
	Perforated interval from 24-34 ft bgs		
	Perforation Size	0.010	in.
H	Surface Seal from	0 to 1	ft.
	Seal Material	concrete	
I	Backfill from	1 up to 19	ft.
	Seal Material	neat cement	
J	Seal will be a minimum of 2 ft thick		
	Seal Material	hydrated bentonite from 19 to 22 feet bgs	
K	Sand Pack minimum of 2 ft above screen to the bottom		
	Pack Material	Cemex # 2/12 sand from 22-34 feet bgs	
L	Bottom Seal	N/A	ft.
	Seal Material	N/A	
M	Traffic-rated, water-resistant, steel well box		
	Locking expandable well plug with lock		

Note: Depths measured from initial ground surface.

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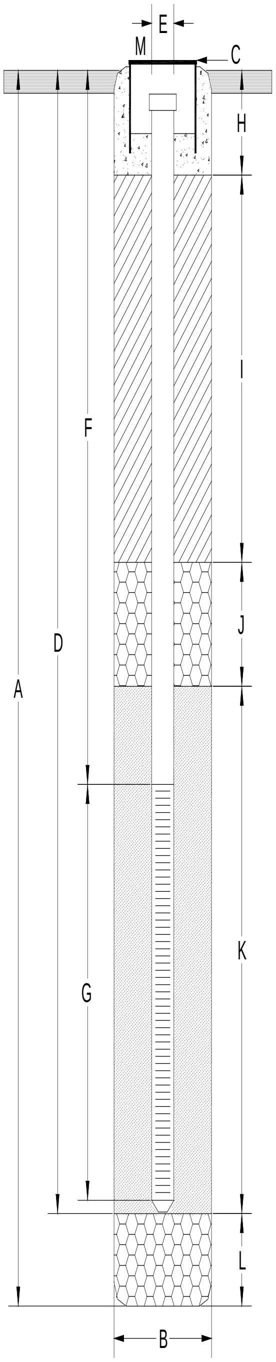
Well No.

City of Trinidad ASBS Project **MW-6**

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	17-Jan-12	**Monitoring Well Construction Details**

MW-7 MONITORING WELL CONSTRUCTION DETAILS



A	Total Depth of Boring	55	ft.
B	Diameter of Boring	8	in.
	Drilling Method	hollow stem auger	
C	Top of Box Elevation	175.33	ft.
	☐ Referenced to Mean Sea Level		
	☒ Referenced to Project-Datum		
D	Casing Length	55	ft.
	Material	schedule 40 PVC	
E	Casing Diameter	2	in.
F	Depth to Top Perforations	45	ft.
G	Perforated Length	10	ft.
	Perforated interval from 45-55 ft bgs		
	Perforation Size	0.010	in.
H	Surface Seal from	0 to 1	ft.
	Seal Material	concrete	
I	Backfill from	1 up to 40	ft.
	Seal Material	neat cement	
J	Seal will be a minimum of 2 ft thick		
	Seal Material	hydrated bentonite from 40 to 43 feet bgs	
K	Sand Pack minimum of 2 ft above screen to the bottom		
	Pack Material	Cemex # 2/12 sand from 43-55 feet bgs	
L	Bottom Seal	N/A	ft.
	Seal Material	N/A	
M	Traffic-rated, water-resistant, steel well box		
	Locking expandable well plug with lock		

Note: Depths measured from initial ground surface.

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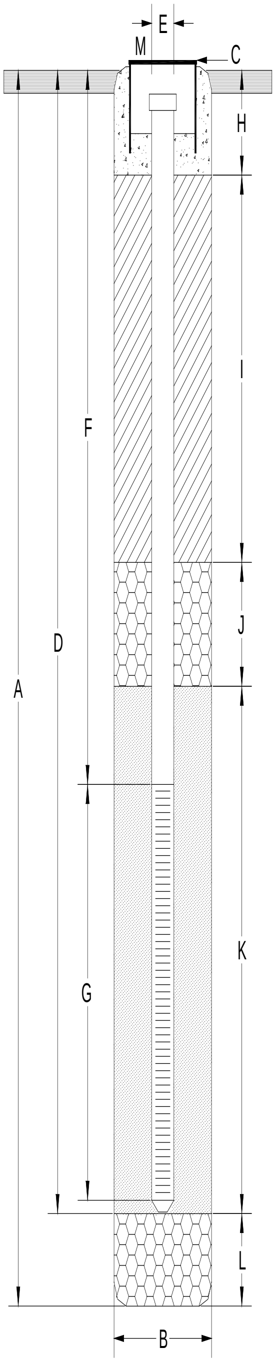
Well No.

City of Trinidad ASBS Project **MW-7**

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	17-Jan-12	**Monitoring Well Construction Details**

MW-8 MONITORING WELL CONSTRUCTION DETAILS



A	Total Depth of Boring	49	ft.
B	Diameter of Boring	8	in.
	Drilling Method	hollow stem auger	
C	Top of Box Elevation	176.72	ft.
	☐ Referenced to Mean Sea Level		
	☒ Referenced to Project-Datum		
D	Casing Length	49	ft.
	Material	schedule 40 PVC	
E	Casing Diameter	2	in.
F	Depth to Top Perforations	29	ft.
G	Perforated Length	20	ft.
	Perforated interval from 29-49 ft bgs		
	Perforation Size	0.010	in.
H	Surface Seal from	0 to 1	ft.
	Seal Material	concrete	
I	Backfill from	1 up to 25	ft.
	Seal Material	neat cement	
J	Seal will be a minimum of 2 ft thick		
	Seal Material	hydrated bentonite from 25 to 28 feet bgs	
K	Sand Pack minimum of 2 ft above screen to the bottom		
	Pack Material	Cemex # 2/12 sand from 28-49 feet bgs	
L	Bottom Seal	N/A	ft.
	Seal Material	N/A	
M	Traffic-rated, water-resistant, steel well box		
	Locking expandable well plug with lock		

Note: Depths measured from initial ground surface.

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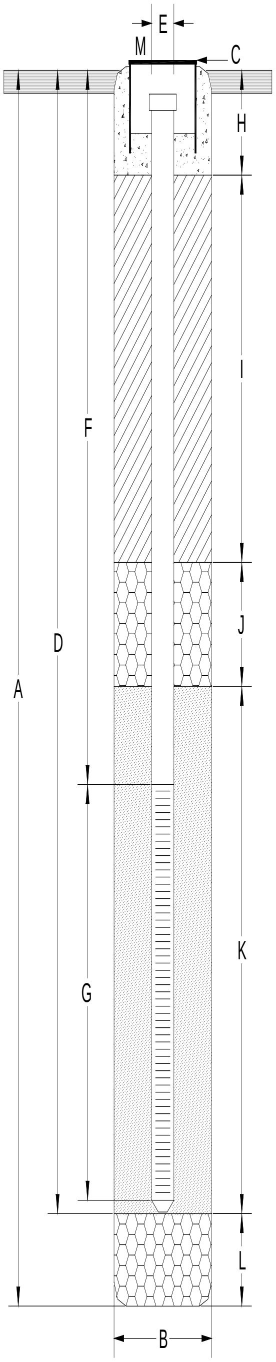
Well No.

City of Trinidad ASBS Project **MW-8**

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	11-Jan-12	**Monitoring Well Construction Details**

MW-9 MONITORING WELL CONSTRUCTION DETAILS



A Total Depth of Boring 70 ft.

B Diameter of Boring 8 in.

Drilling Method hollow stem auger

C Top of Box Elevation 174.23 ft.

☐ Referenced to Mean Sea Level

☒ Referenced to Project-Datum

D Casing Length 70 ft.

Material schedule 40 PVC

E Casing Diameter 2 in.

F Depth to Top Perforations 50 ft.

G Perforated Length 20 ft.

Perforated interval from 50-70 ft bgs

Perforation Size 0.010 in.

H Surface Seal from 0 to 1 ft.

Seal Material concrete

I Backfill from 1 up to 45 ft.

Seal Material neat cement

J Seal will be a minimum of 2 ft thick

Seal Material hydrated bentonite from 45 to 48 feet bgs

K Sand Pack minimum of 2 ft above screen to the bottom

Pack Material Cemex # 2/12 sand from 48 to 70 feet bgs

L Bottom Seal N/A ft.

Seal Material N/A

M Traffic-rated, water-resistant, steel well box

Locking expandable well plug with lock

Note: Depths measured from initial ground surface.

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Well No.

City of Trinidad ASBS Project **MW-9**

JOB NUMBER	REVIEWED BY	DATE	
106311005	P.Sullivan	3-Feb-12	**Monitoring Well Construction Details**

Appendix E
GHD SOPs

WINZLER & KELLY

STANDARD OPERATING PROCEDURES
GROUNDWATER LEVEL MEASUREMENTS

1.0 OBJECTIVE

To establish accepted procedures for measuring the depth to groundwater in monitoring wells and piezometers.

1.1 Background

Groundwater level measurements are required to determine the groundwater gradient or flow direction. These Standard Operating Procedures (SOPs) establish the procedures for measuring depth to.

1.2 Personnel Required and Responsibilities

Project Manager: The Project Manager (PM) is responsible for ensuring that field personnel have been trained in these procedures and for verifying that water level have been collected in compliance with this SOP.

Field Technician: The Field Technician is responsible for complying with this SOP, and the equilibrated water level in the monitoring well.

2.0 EQUIPMENT REQUIRED

- Tape measure
- Water Level Data Form/pencil
- Watch
- Disposable gloves
- Distilled water
- Alconox soap
- Containers to hold rinsate water
- Site Safety Plan and Hospital Map
- Keys to wells
- Tools to open wells

3.0 PROCEDURE

After reviewing the Site Safety Plan and determining the type and concentrations of contaminants that may be present on site, the field personnel will don the proper level of personal protection prior to opening monitoring wells.

Open monitoring wells to be measured and remove locks and expandable caps. Allow wells to equilibrate to atmospheric pressure for a minimum of 15 minutes. Record time and visual observations regarding well access, condition, security, etc., on water level data sheet.

3.1 Procedure for electronic water-level meter

- Decontaminate probe with potable water and Alconox mix. Rinse with distilled or deionized water.
- Lower probe into the well and record the depth to.
- Groundwater elevation shall be calculated as follows:
- GW Elevation = (TOC) - (depth to water).
- TOC indicates top of casing elevation as surveyed.

WINZLER & KELLY

STANDARD OPERATING PROCEDURES
for
MONITORING WELL INSTALLATION IN THE UNCONFINED AQUIFER

1. Objective

To provide an accepted method for the installation of monitoring wells in the unconfined aquifer for sites impacted with chemical contaminants.

2. Background

Monitoring wells are installed in accordance with the California Well Standards (Bulletin 74-90) and the appropriate lead agency guidelines.

Careful consideration should be given to the specific gravity of the contaminants of concern and screening the upper or lower portion of the aquifer.

Except where otherwise required, W&K only utilize disposable polyethylene bailers to collect groundwater samples.

3. Personnel Required and Responsibilities

Professional Geologist: A Professional Geologist (PG) is responsible for ensuring that the monitoring well is properly installed and oversee the logging of the monitoring well and for ensuring that field personnel have been trained in the use of this procedure.

Staff Geologist: A staff geologist (SG) has 0.5 to 5 years experience logging borings and installing monitoring wells. The SG is responsible for complying with the procedure, installing the well, collection of samples, containerization of samples, and documentation. The SG will call into the PG with proposed well construction, soils and contaminant data to obtain approval prior to well installation.

4. Equipment Required

- Level D Safety Equipment
- Boring Log form / Munsell Soil Charts
- Sample containers - provided by the laboratory
- En Core® Sampler Set and sample containers
- Sample labels/Indelible marker
- Disposal gloves
- Ice chest with ice
- Unified Soil Classification System Guide

5. Procedure

- Prior to drilling the monitoring well boring Winzler & Kelly will obtain all required permits. A Site-Specific Safety Plan detailing site hazards, site safety, and control will be prepared prior to any field work. At least 48 hours prior to drilling Underground Services Alert (USA) will be notified of the planned work.

- Prior to installing a monitoring well, log the boring and sample according to Winzler & Kelly's Standard Operating Procedures for *Soil and Water Sampling from a Boring.*

- Use a PID during the drilling and sampling activities to screen for the presence of Volatile Organic Compounds (VOCs).

- Use a hollow-stem rotary auger drill rig set up with a 9-inch auger to complete the well drilling and to assist in the well installation.

- Extend the well borings at least 10 feet into the aquifer under investigation. At a minimum, obtain soil samples by driving an 18- or 24-inch long split spoon sampler continuously for the first well and at 5-foot intervals for the other wells. Retain one 6-inch sample tube from each 5-foot interval for possible submittal to the analytical laboratory. Collect soil samples at the soil-water interface, at notable changes in lithology, and in areas of observed chemical contaminant impact.

- For the laboratory analysis of non-VOCs, obtain soil samples in clean brass tubes during the drilling as part of the monitoring well installation process. Cap the 6-inch tube of soil selected for laboratory analysis with aluminum foil or Teflon tape and plastic caps; label and store samples in a cooler, on ice. Transport the soil samples to a state-certified analytical laboratory under chain-of-custody documentation. Handle soil samples that will be selected for laboratory analysis in accordance with Winzler & Kelly's Standard Operating Procedures for *Soil and Water Sampling from a Boring*.

- For the laboratory analysis of VOCs, soil samples will be collected with a split spoon sampler or direct-push sample barrel that is not lined with any sleeves. Soil will be scraped away using a clean trowel or other device to get to the interior of the sample. As per EPA Method 5035, a new disposable En Core® Sampler will be in the En Core® handle. Three clean En Core® sample tubes will be driven into the soil and filled completely to avoid air space. The En Core® sample tube will be retracted from the soil and capped with the locking cap, and inserted in the provided envelope. Each envelope will be labeled with the job number, the sample identification, date and time of collection, the sampler's name, and the analyses required. Each set of three En Core® samples will then be placed in an ice chest (chilled to 4°C) until delivered to a state-certified laboratory under strict chain-of-custody documentation, where they will weigh and preserve each sample within 48-hours of collection.

A fourth sample will be collected for laboratory screening, by driving a pre-cleaned container, such as a glass jar or a brass tube into the soil, capping it with Teflon or aluminum sheeting, and tight-fitting plastic caps.

A clean set of En Core® samplers and brass tube will then be driven into the soil until each are completely full.

- Classify soil types and log under the Unified Soil Classification System using the ASTM Visual Manual Procedure (D 2488-84) and Munsell Soil Color Charts. Field screen the soil headspace within a sealed sample bag, using a portable Organic Vapor Meter. Winzler & Kelly uses a photo-ionization detector (PID) to assess relative concentrations of volatile constituents in the soil samples, and also to monitor the breathing zone.

- Include the lithology, moisture, density, colors and depth sample identification, PID measurements and well construction details on the boring logs as appropriate. Include the boring logs generated from the field activities in the Report of Investigation.

- If a clay layer is encountered, perform continuous sampling to assess its thickness. A clay aquitard shall not be penetrated more than 3 feet. If cross contamination of aquifers is possible, use conductor casings and packers, as appropriate to maintain groundwater quality.

- Depending on the season during the drilling activities (high water table season or low water table season), the screened interval should be placed to allow for fluctuations in the water table. The screened casing should be placed about 5-feet above the anticipated high water table, and should extend a maximum of 15 feet below the water table.

- The last page of this SOP illustrates the Typical Monitoring Well Construction Detail.

- Use two-inch diameter schedule 40-PVC, flush-threaded well screen and install through the hollow-stem augers. If the soils are stiff enough to open hole the boring, then make sure centralizers are installed on the outside of the casing every 10-feet.

- Slowly install a uniform filter pack from the bottom of each boring to a depth of 6 inches and preferably 1-foot above the top of the well screen. This step is imperative because if the sand is poured too quickly, it may bridge. The bridging can also cause the well casing to move upward. If this happens and the well bridge cannot be broken, remove the well casing and auger out all the sand and reinstall.

- Use a clean, weighted tape measure to ensure proper placement of the sand and that sand always stays in the auger. This prevents any possible cave ins.

- Use Lonestar #2/16, or #2/12 Monterey sand or equivalent with a 0.010-inch slot or 0.020-inch slot screen. The screen size is dependent on the lithology. If the saturated soil consists of coarser material, then 0.020-inch slot with #3 Lonestar Sand (or equivalent) should be used.

- Place a minimum 1-foot thick seal of **hydrated** bentonite pellets over the filter pack. Grout the remainder of the boring with a cement/bentonite slurry not exceeding 5 percent bentonite to 1 foot below the ground surface. The top of the PVC casing will be approximately 2 inches below grade. Slide slip cap over the top of the casing.

- Place empty Lonestar sandbags around the casing to ensure no clods of dirt fall into the boring until ready to place the surface seal.

- Protect the wells by 8-inch minimum to a 12-inch maximum, flush-mounted traffic boxes set in concrete, with locking well caps. The top of the traffic boxes will be set above grade with a gently sloping concrete rim. The monitoring well identification number should be scribed into the concrete rim before it completely sets.

- Refer to other SOPs for development and sampling the wells.

- A depth to water measurement should be collected after the sample is collected. The measurement and time shall be documented in the logbook.

- Upon completion of the well installation, each well will be closed and secured by replacing the well cap, securing the lock and bolting down the lid of the flush-mounted traffic box. Ensure the box does not sink in the wet concrete.

- Properly drum or dispose of used gloves and any other PPE gear, after each use.

Explanation for Winzler & Kelly Boring Logs

Major Division	Group	Symbol	Description
Coarse Grained Soils (more than half of soil > No. 200 sieve)	**Gravels** (More than half of coarse fraction > no. 4 sieve size)	**GW**	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Sandy gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-silt mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	**SW**	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
Fine Grained Soils (more than half of soil < No. 200 sieve)	**Silts and Clays LL = < 50**	**ML**	Inorganic silts and very fine sands, rock flour, silty fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays LL = > 50	**MH**	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic silts of high plasticity, fat clays
		OH	Organic clays of high plasticity, organic silty clays, organic silts
Highly Organic Soils		**Pt**	Peat and other highly organic soils

Grain Size Chart

Classification	Range of Grain Sizes: U.S. Standard Sieve Size	Range of Grain Sizes: Grain Size In Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 7.76
coarse	3" to 3/4"	76.2 to 4.76
fine	3/4"to No.4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No.4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

Relative Density (SPT)

SANDS AND GRAVELS	BLOWS/FOOT
VERY LOOSE	0 – 4
LOOSE	4 – 10
MEDIUM DENSE	10 – 30
DENSE	32 – 50
VERY DENSE	OVER 50

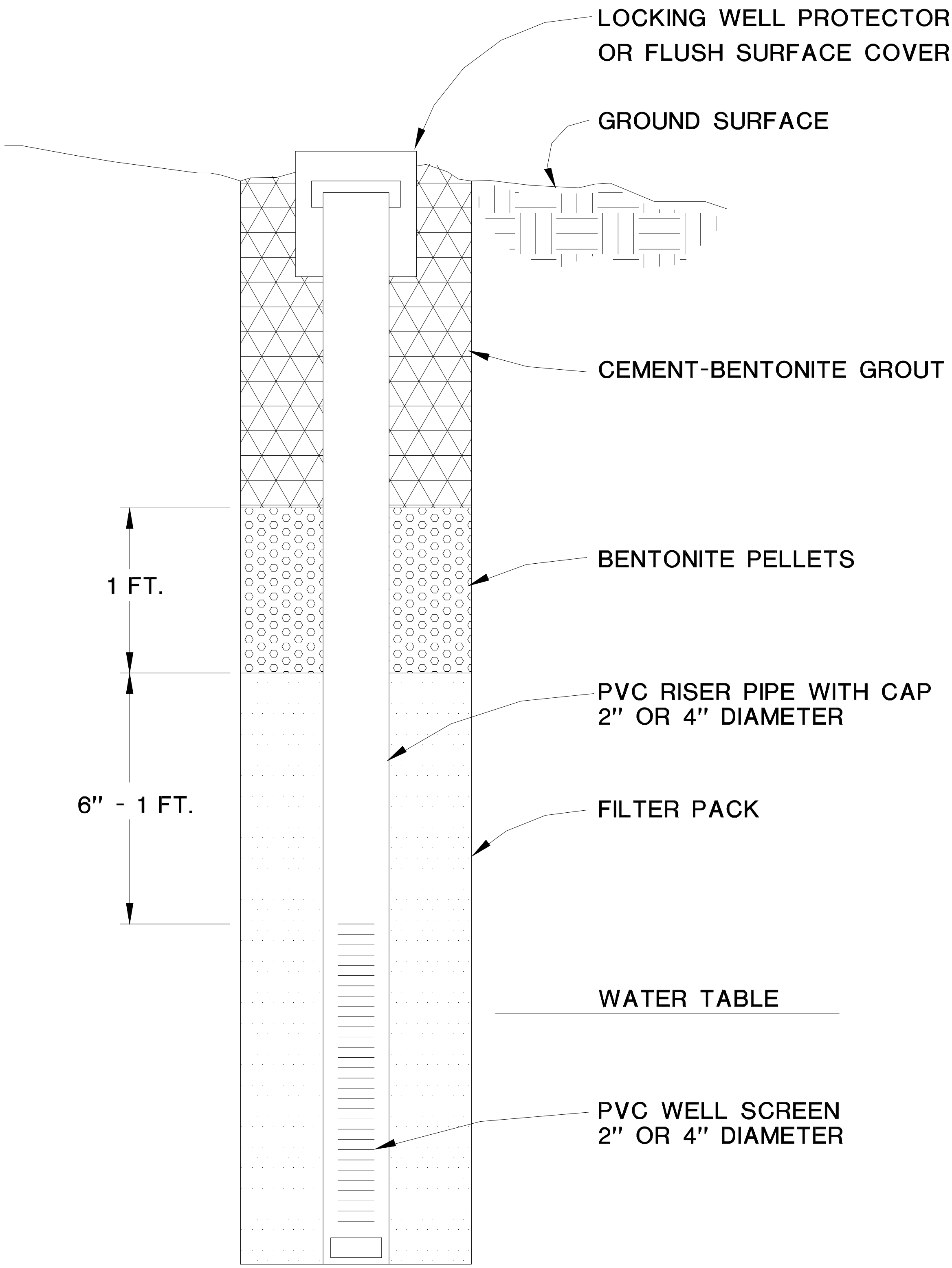
Consistency (SPT)

SILTS AND CLAYS	BLOWS/FOOT
VERY SOFT	0 – 2
SOFT	2 – 4
MEDIUM STIFF	4 – 8
STIFF	8 – 16
VERY STIFF	16 – 22
HARD	OVER 32

▽ **Initial water level measured during drilling (date in italics)**

▼ **Static water level measured after well development (date in italics)**

× **Depths where soil samples were recovered**



TYPICAL MONITORING WELL CONSTRUCTION DIAGRAM

NOT TO SCALE

WINZLER & KELLY

STANDARD OPERATING PROCEDURES
for
SOIL BORING INSTALLATION

1.0 Objective

To establish procedures for sampling soil and water from using a hand auger or direct push tools to install soil borings.

2.0 Background

During subsurface investigations it is necessary to obtain discrete soil and water samples from below the ground surface. This SOP establishes the procedures for collecting soil and groundwater samples from borings using hand tools on projects requiring near-surface data.

3.0 Personnel Required and Responsibilities

Project Manager: The Project Manager (PM) is responsible for ensuring that field personnel have been trained in the use of these procedures and for verifying that drilling water and soil sampling activities are performed in compliance with this SOP.

Project Scientist: The responsible professional in charge of the field work must determine the exact location and depth of each boring, and decide on the sampling interval. The project scientist must collect samples; prepare them for transport to the laboratory, and record lithologic and other observations. The Project Scientist is responsible for complying with this SOP.

4.0 Equipment Required

- Hand auger kit or direct push boring tools
- Core drill and power supply if boring to be installed through hard surface
- Split spoon sampler or direct push sample barrel
- Brass or stainless steel sample liners and plastic end caps
- Soil sampling jars
- Aluminum foil or Teflon sheeting
- Decontamination equipment
- Containers for decontamination rinseate
- Disposable gloves
- Sample labels
- Field guide for logging boreholes
- Munsell color charts
- Putty knife
- Boring logs
- Photoionization detector (PID)
- Ice/ice chest

- Sealable plastic storage bags
- Indelible marker that will not transfer volatile compounds to sampling container.

5.0 Procedure

Borings will be installed using hand augers, or small diameter pushrods. Borings will extend to the groundwater surface or deeper as specified by the project requirements. Typically, soil samples will be obtained either continuously, or at a minimum of 5-foot intervals for lithologic logging, on site field screening, and potential chemical analyses. Additional soil samples will be obtained at any notable changes in lithology and at any obvious areas of contamination.

- Soil samples will be collected in a hand auger, split spoon sampler or direct-push sample barrel lined with clean brass or stainless steel sleeves. A six-inch interval of the sample will be capped with aluminum foil or Teflon sheeting and plastic end caps, labeled, wrapped in a plastic storage bag and stored in a cooler, on ice. Sample numbers and depths will be noted on the boring logs.
- The remaining sample will be used for color and soil type classification using the Unified Soil Classification System and Munsell color charts. A portion of each sample will be field-screened with a photo-ionization detector. Results of classification and field screening will be recorded on the boring logs.
- Sample equipment will be decontaminated in an Alconox detergent solution and rinsed in deionized or tap water between sampling intervals.
- If a hydropunch sampler is to be used to collect water samples, borings will terminate at the groundwater surface. A hydropunch-type groundwater sampling device will be lowered into the hollow stem augers or the drive casing, and driven three to four feet into the aquifer. Groundwater will be allowed to flow into the hydropunch.
- If a hydropunch type sampler is not used, the boring will be extended 3 to 5 feet into the aquifer. The augers or drive casing will be pulled back to allow for water to enter the boring. If caving of the bore hole occurs, temporary PVC casing may be lowered into the drive casing or hollow stem augers prior to retraction of the drive casing.
- Groundwater will be sampled using a small diameter stainless steel or disposable polyethylene bailer.
- Groundwater samples will be transferred from the bailer to appropriate size/type containers with the appropriate preservatives, as required by the project needs. Precautions will be taken to avoid capturing air bubbles in the samples. Sample containers will be labeled, wrapped in plastic bags and stored in a cooler, on ice. The water samples will be transported to a State-certified laboratory for the appropriate chemical analyses.
- Soil borings will be closed by filling to 6 inches below the surface with bentonite or a cement/bentonite grout mixture, not exceeding 5% bentonite.

Appendix F
DTW Measurements Field Forms

GHD Inc.

WATER LEVEL MEASUREMENT DATA SHEET

PROJECT NAME: TRINIDAD ASBS PH1 TODAY'S DATE: 03/12/12
PROJECT NUMBER: 0106311005.11005 FIELD PERSONNEL: KEITH KORBIN

WELL NUMBER	OPEN WELL	INITIAL WATER LEVEL		FINAL WATER LEVEL		COMMENTS
	Time	Time	Depth to Water (ft. bgs.)	~~Time~~ TOTAL WELL	Depth to ~~Water~~ (ft. bgs.)	
MW-7	1525	1620	40.35'		54.22'	
MW-8	1530	1628	44.21'		48.92'	
MW-9	1536	1639	53.88'		70.11'	
MW-1	1541	1649	16.99'		27.86'	
MW-3	1548	1705	40.62'		50.98'	
MW-2	1553	1712	29.35'		38.72'	
MW-5	1559	1721	38.22'		42.53'	
MW-4	1606	1732	34.60'		38.93'	
MW-6	1612	1747	18.25'		33.90'	

ON SITE @ 1515
OFF SITE @ 1803

ALL WELL CASES MARKED WITH "NOTCH" @ NORTH
ALL WELL CAPS & COVERS SECURE

Weather Conditions Today: VERY WINDY, CLOUDY, SPRINKLES

GHD Inc.

WATER LEVEL MEASUREMENT DATA SHEET

PROJECT NAME: TRINIDAD ASBS PH. I TODAY'S DATE: 04/02/12
PROJECT NUMBER: 0106311005.11005 FIELD PERSONNEL: KEITH KORBIN

WELL NUMBER	OPEN WELL	INITIAL WATER LEVEL		FINAL WATER LEVEL		COMMENTS
	Time	Time	Depth to Water (ft. bgs.)	TOTAL ~~Time~~ WELL	Depth ~~to Water~~ (ft. bgs.)	
MW-7	0902	1041	39.91'	54.22'		
MW-8	0912	1026	43.68'	48.93'		
MW-9	0918	1038	56.13'	70.11'		
MW-1	0925	1052	14.42'	28.77'		
MW-3	0930	1103	39.01'	50.95'		
MW-2	0935	1116	27.86'	38.65'		
MW-5	0942	1131	37.69'	42.53'		
MW-4	0947	1142	33.82'	38.93'		
MW-6	0953	1157	16.35'	33.97'		
ON SITE @ 0845						
OFF SITE @ 1210						
* ALL WELLS: CLEANED CAPS, VAULT/BOXES, & STAMPED I.D. MARKINGS ON COVERS						

Weather Conditions Today: CALM, MOSTLY CLOUDY

GHD Inc.

WATER LEVEL MEASUREMENT DATA SHEET

PROJECT NAME: TRINIDAD ASBS PH 1 TODAY'S DATE: 06/28/12
PROJECT NUMBER: 016311005.11005 FIELD PERSONNEL: KEITH KORBIN

WELL NUMBER	OPEN WELL	INITIAL WATER LEVEL		~~FINAL WATER LEVEL~~ TOTAL WELL DEPTH		COMMENTS
	Time	Time	Depth to Water (ft. bgs.)	Time	Depth to Water (ft. bgs.)	
MW-7	0931	1030	37.76'		54.10'	
MW-8	0936	1057	41.81'		48.92'	
MW-9	~~0948~~	1110	55.55'		70.00'	
MW-1	0957	1120	17.74'		28.77'	
MW-3	1002	1130	40.51'		50.95'	
MW-2	0954	1137	27.33'		38.24'	
MW-5	1015	1152	37.00'		42.54'	
MW-4	1017	1159	34.88'		38.94'	
MW-6	1021	1206	16.90'		33.90'	
EX-1	1010 *	1143	9.90'		15.52'	
EX-2	0944*	1047	DRY		34.49'	
	* BOX FULL OF WATER					
	DEPART	EKA	0845			
	ON-SITE	@	0915			
	OFF-SITE	@	1215			
	LUNCH	→	1227			
	ARRIVE	EKA	1253			

Weather Conditions Today: CLEAR, DRY, WARM, SOME CLOUDS
LIGHT BREEZE

GHD Inc.

WATER LEVEL MEASUREMENT DATA SHEET

PROJECT NAME: TRINIDAD ASBS PH 1 TODAY'S DATE: 9/20/12
PROJECT NUMBER: 0106311005.11005 FIELD PERSONNEL: KEITH KORBIN

WELL NUMBER	OPEN WELL	INITIAL WATER LEVEL		~~FINAL WATER LEVEL~~		COMMENTS
	Time	Time	Depth to Water (ft. bgs.)	TOTAL WELL ~~Time~~ DEPTH	Depth to Water (ft. bgs.)	
MW-7	1322	1414	39.51'	54.10'		ALLEN SCREWS CLOGGED W/ DEBRIS
MW-8	1332	1441	33.20'	48.93'		IRREGULAR SOUNDING ON DEPTH PROBE*
MW-9	1336	1449	56.52'	70.00'		
MW-1	1343	1503	19.52'	28.76'		WASHED SAND AWAY W/ DI WATER
MW-3	1352	1519	42.88'	50.98'		
MW-2	1355	1526	30.06'	38.02'		≥ 12" MUD/SILT @ BOTTOM OF WELL
MW-5	1358	1536	39.11'	42.54'		
MW-4	1401	1543	36.44'	38.95'		
MW-6	1405	1551	18.69'	33.96'		
EX-1	1348	1510	11.36'	14.52'		
EX-2	1328	1424	DRY	34.48'		
	DEPART:	1245				
	ONSITE:	1315				
	OFFSITE:	1558				
	EUREKA:	1625				

* SEVERAL ATTEMPTS TO DETERMINE DTW. WHITE GRANULATED MATERIAL OBSERVED ON PROBE.

Weather Conditions Today: OVERCAST, MILD, LIGHT BREEZE

Appendix G
Spectrum Geophysical Report

NOTE: SPECTRUM GEOPHYSICAL REPORT

WILL BE APPENDED TO THE FINAL DOCUMENT

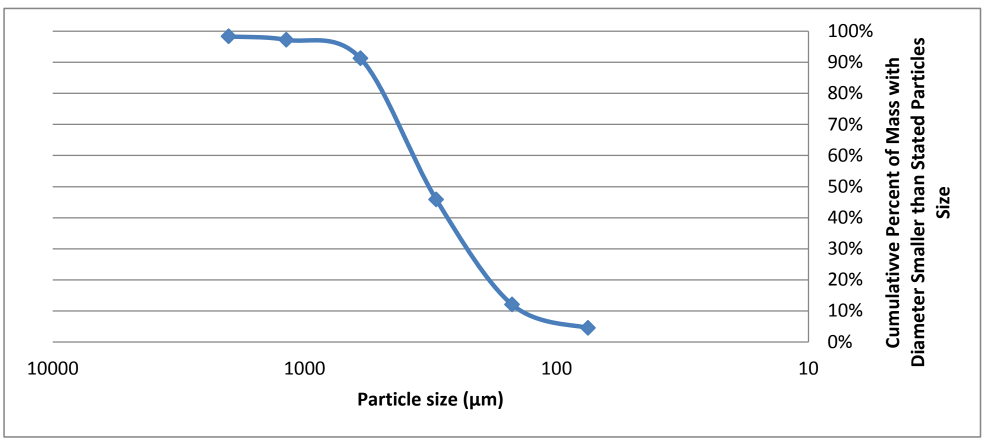
Appendix H
Sieve Analysis Laboratory Data Sheets

Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-16 (20-22 feet bgs)	Soil Description:	
Sample Wt. (dry):	358.9 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	5.9	2%	353	98%	
16	1180	4.0	3%	349	97%	
30	600	21.4	9%	327.6	91%	
50	300	163.2	54%	164.4	46%	
100	150	121.3	88%	43.1	12%	
200	75	27.0	96%	16.1	4%	

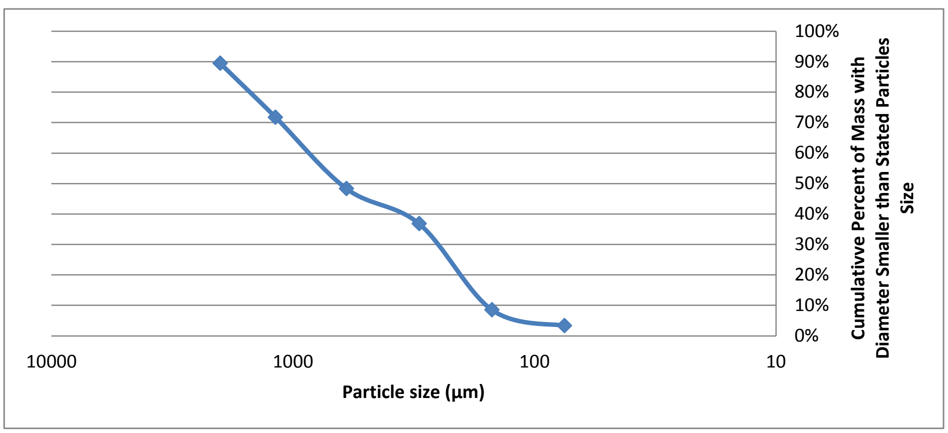


Sieve Analysis Test -ASTM C117 and C136

Job Name: Trinidad ASBS
Project Location: Trinidad, California
Job Number: 106311005 Date: 9/26/2012
AP#: Tested By: Anna Gower

Sample #: SB-11 (60-62 feet bgs) Soil Description:
Sample Wt. (dry): 628.0 grams Sample Location:

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	66.4	11%	561.6	89%	
16	1180	111.1	28%	450.5	72%	
30	600	147.3	52%	303.2	48%	
50	300	72.3	63%	230.9	37%	
100	150	177.5	91%	53.4	9%	
200	75	32.5	97%	20.9	3%	

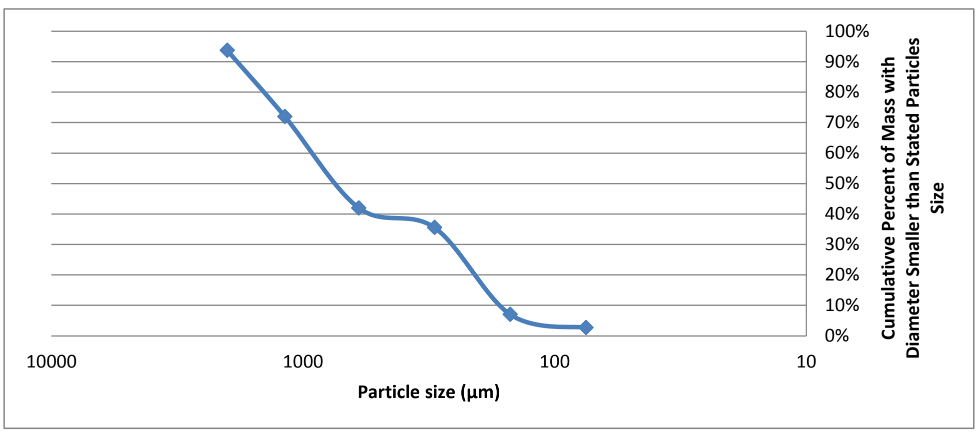


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-18 (60-61 feet bgs)	Soil Description:	
Sample Wt. (dry):	328.2 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	20.8	6%	307.44	94%	
16	1180	71.3	28%	236.14	72%	
30	600	98.4	58%	137.74	42%	
50	300	21.2	64%	116.54	36%	
100	150	93.6	93%	22.94	7%	
200	75	14.1	97%	8.84	3%	

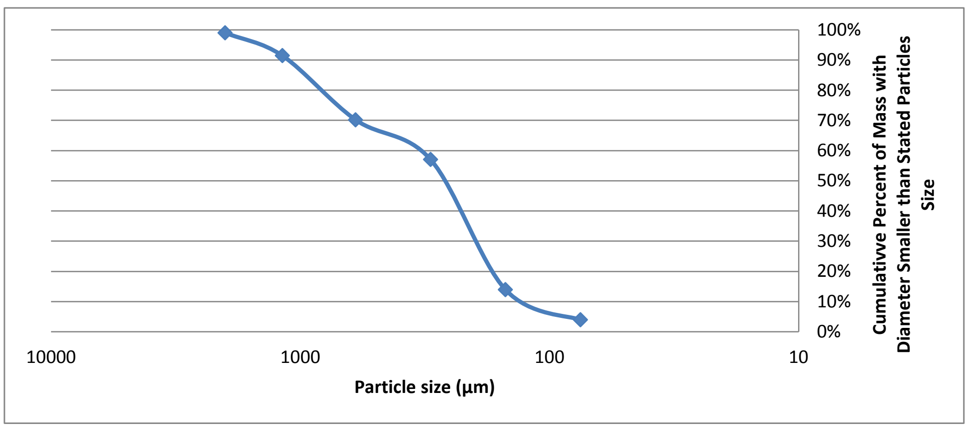


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-4 (45-47 feet bgs)	Soil Description:	
Sample Wt. (dry):	178.5 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	1.8	1%	176.7	99%	
16	1180	13.5	9%	163.2	91%	
30	600	37.9	30%	125.3	70%	
50	300	23.5	43%	101.8	57%	
100	150	77	86%	24.8	14%	
200	75	17.8	96%	7	4%	

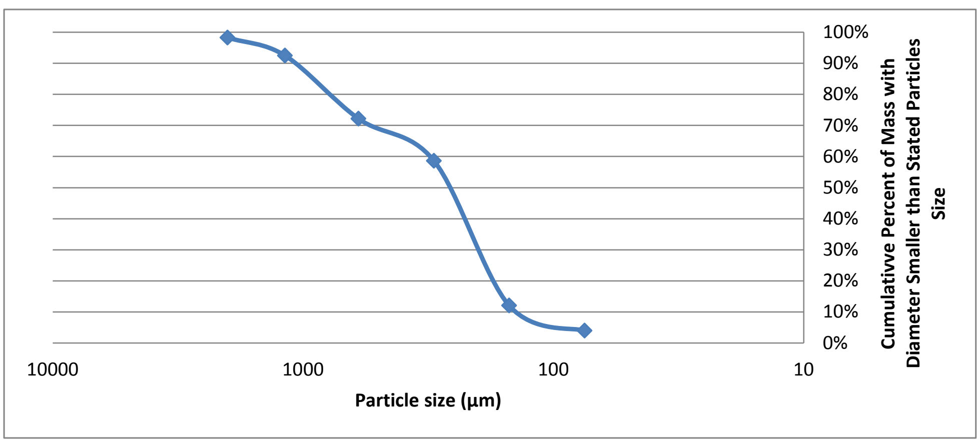


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS
Project Location:	Trinidad, California
Job Number:	106311005
Date:	9/26/2012
AP#:	
Tested By:	Anna Gower

Sample #:	SB-6 (50-52 feet bgs)
Soil Description:	
Sample Wt. (dry):	543.2 grams
Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	9.35	2%	533.85	98%	
16	1180	31.44	8%	502.41	92%	
30	600	110.45	28%	391.96	72%	
50	300	73.5	41%	318.46	59%	
100	150	253.3	88%	65.16	12%	
200	75	43.7	96%	21.46	4%	

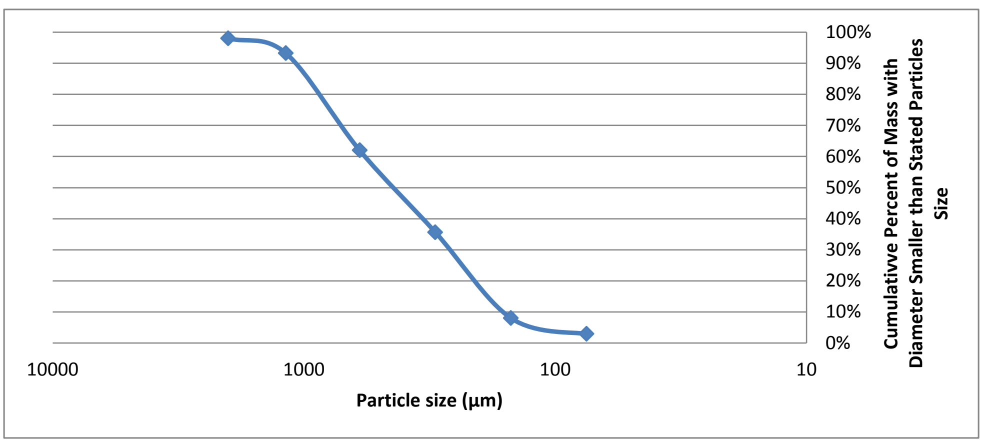


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-17 (30-32 feet bgs)	Soil Description:	
Sample Wt. (dry):	661.0 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	12.9	2%	648.1	98%	
16	1180	31.8	7%	616.3	93%	
30	600	206.6	38%	409.7	62%	
50	300	174.2	64%	235.5	36%	
100	150	182.7	92%	52.8	8%	
200	75	33.8	97%	19	3%	

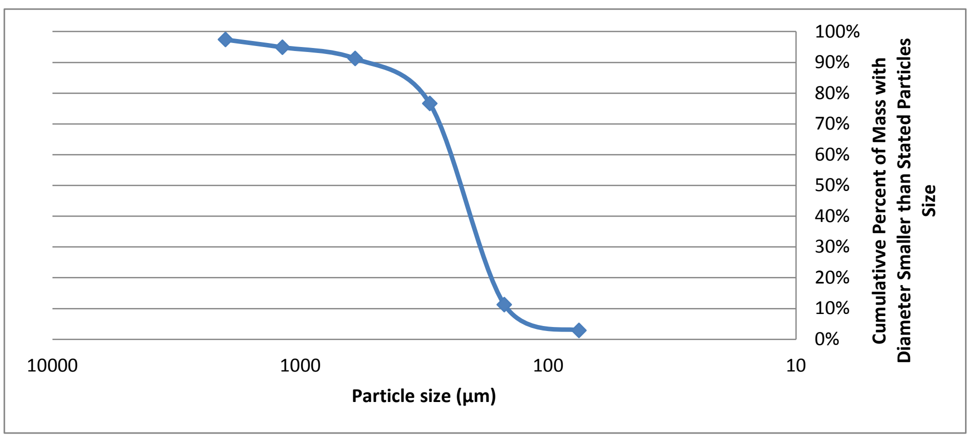


Sieve Analysis Test -ASTM C117 and C136

Job Name: Trinidad ASBS
Project Location: Trinidad, California
Job Number: 106311005 Date: 9/26/2012
AP#: Tested By: Anna Gower

Sample #: SB-3 (20-22 feet bgs) Soil Description:
Sample Wt. (dry): 507.6 grams Sample Location:

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	13.3	3%	494.3	97%	
16	1180	12.6	5%	481.7	95%	
30	600	18.7	9%	463	91%	
50	300	74.1	23%	388.9	77%	
100	150	331.8	89%	57.1	11%	
200	75	42.7	97%	14.4	3%	

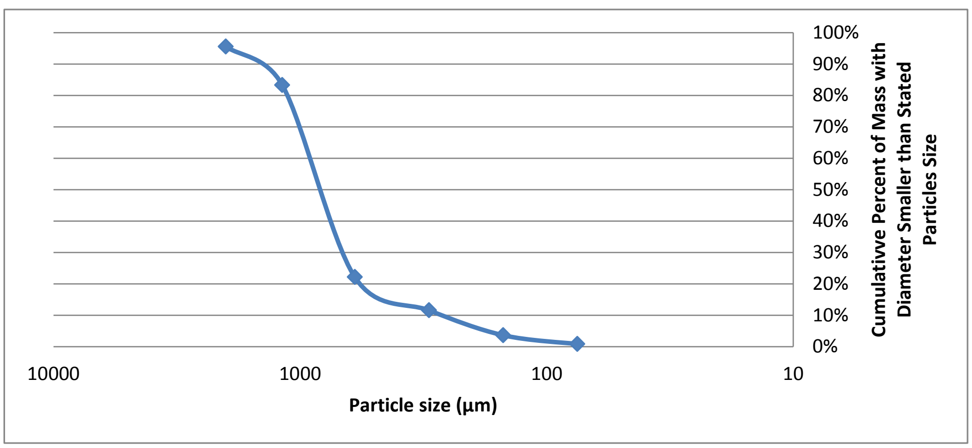


Sieve Analysis Test -ASTM C117 and C136

Job Name: Trinidad ASBS
Project Location: Trinidad, California
Job Number: 106311005 Date: 9/26/2012
AP#: Tested By: Anna Gower

Sample #: SB-5 (55-57 feet bgs) Soil Description:
Sample Wt. (dry): 478.7 grams Sample Location:

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	21.3	4%	457.4	96%	
16	1180	58.8	17%	398.6	83%	
30	600	292.4	78%	106.2	22%	
50	300	50.7	88%	55.5	12%	
100	150	38	96%	17.5	4%	
200	75	13.3	99%	4.2	1%	

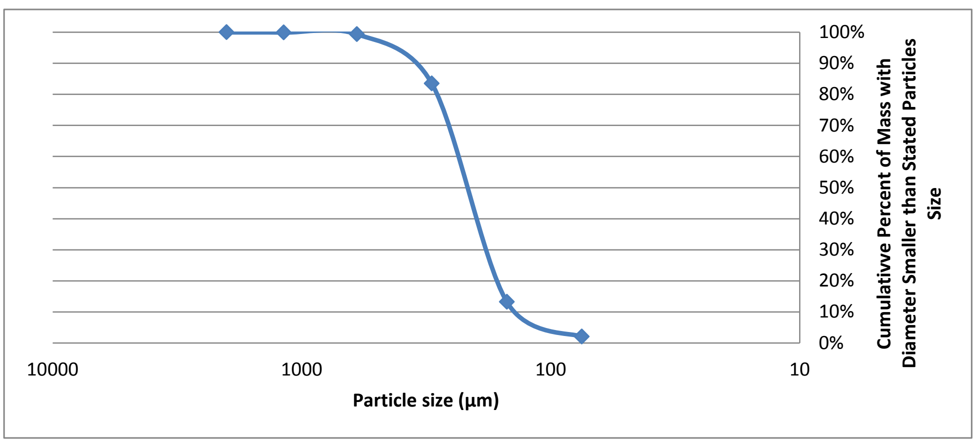


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-8 (35 feet bgs)	Soil Description:	
Sample Wt. (dry):	791.6 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	0.3	0%	791.3	100%	
16	1180	0.4	0%	790.9	100%	
30	600	4.4	1%	786.5	99%	
50	300	125.7	17%	660.8	83%	
100	150	556.1	87%	104.7	13%	
200	75	88.8	98%	15.9	2%	

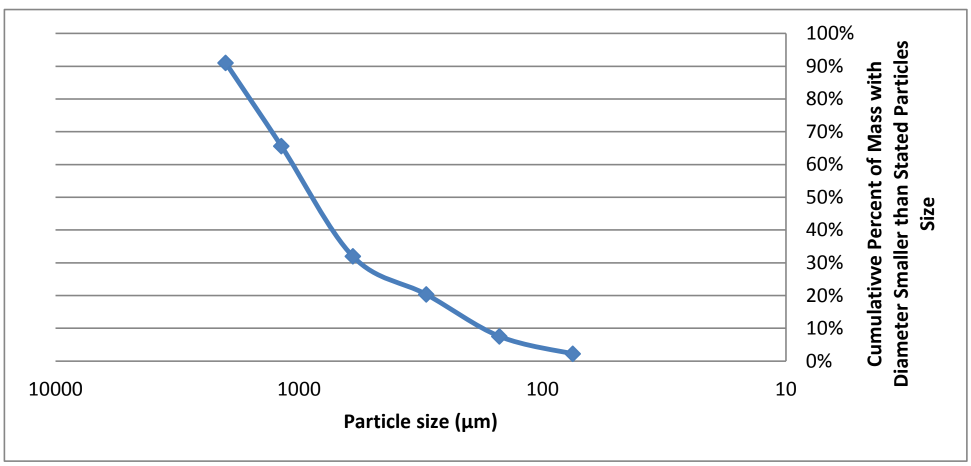


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-1 (35-37 feet bgs)	Soil Description:	
Sample Wt. (dry):	561.2 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	50.5	9%	510.7	91%	
16	1180	142.7	34%	368	66%	
30	600	188.88	68%	179.12	32%	
50	300	64.9	80%	114.22	20%	
100	150	71.9	92%	42.32	8%	
200	75	29.8	98%	12.52	2%	

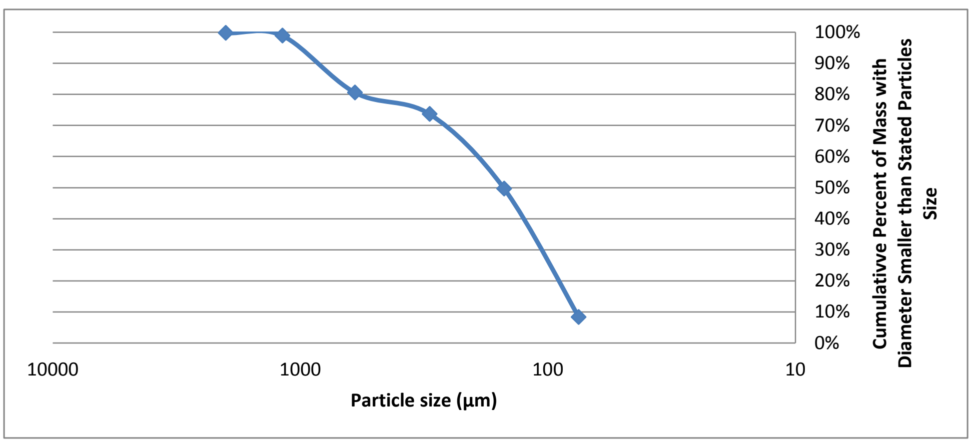


Sieve Analysis Test -ASTM C117 and C136

Job Name: Trinidad ASBS
Project Location: Trinidad, California
Job Number: 106311005 Date: 9/26/2012
AP#: Tested By: Anna Gower

Sample #: SB-13 (20-22 feet bgs) Soil Description:
Sample Wt. (dry): 561.2 grams Sample Location:

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	1.5	0%	559.7	100%	
16	1180	4.9	1%	554.8	99%	
30	600	102.8	19%	452	81%	
50	300	38.8	26%	413.2	74%	
100	150	134.7	50%	278.5	50%	
200	75	231.7	92%	46.8	8%	

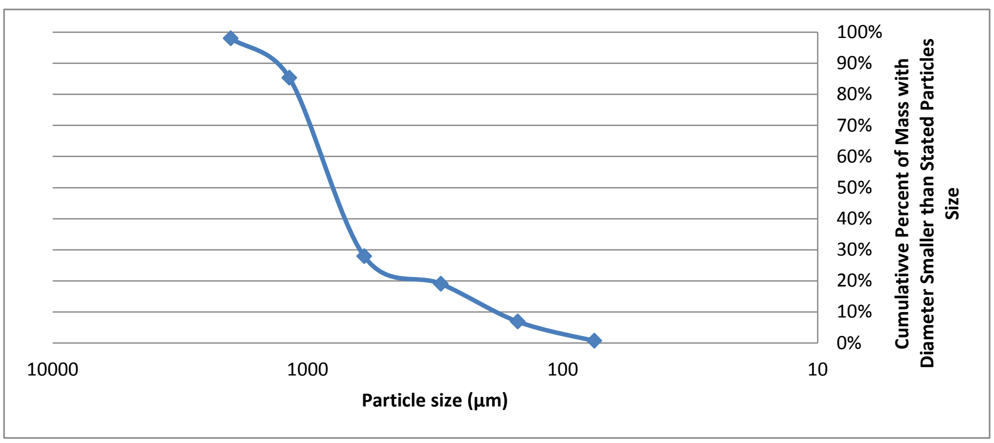


Sieve Analysis Test -ASTM C117 and C136

Job Name: Trinidad ASBS
Project Location: Trinidad, California
Job Number: 106311005 Date: 9/26/2012
AP#: Tested By: Anna Gower

Sample #: SB-2 (25 feet bgs) Soil Description:
Sample Wt. (dry): 646.6 grams Sample Location:

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	12.8	2%	633.8	98%	
16	1180	81.9	15%	551.9	85%	
30	600	371.5	72%	180.4	28%	
50	300	57.3	81%	123.1	19%	
100	150	78.7	93%	44.4	7%	
200	75	40.1	99%	4.3	1%	

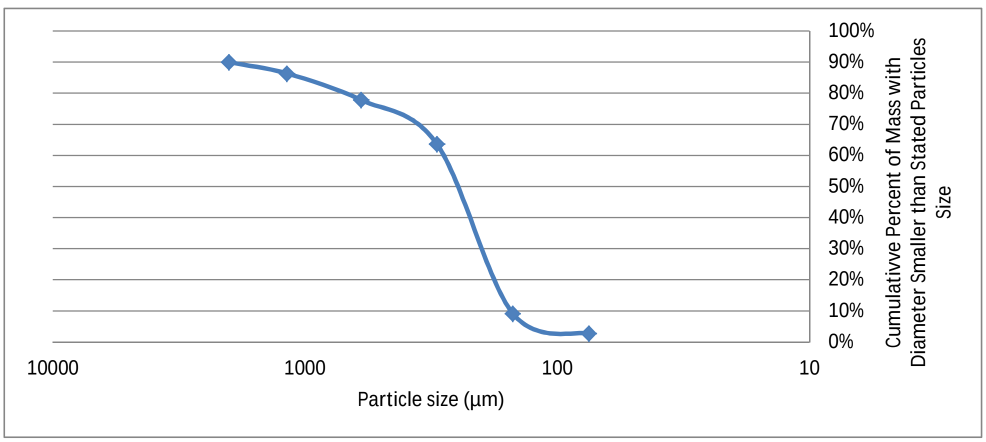


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-15 (5.5 feet bgs)	Soil Description:	
Sample Wt. (dry):	380.4 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	38.17	10%	342.21	90%	
16	1180	13.8	14%	328.41	86%	
30	600	32.3	22%	296.11	78%	
50	300	54.0	36%	242.11	64%	
100	150	207.2	91%	34.91	9%	
200	75	24.6	97%	10.31	3%	

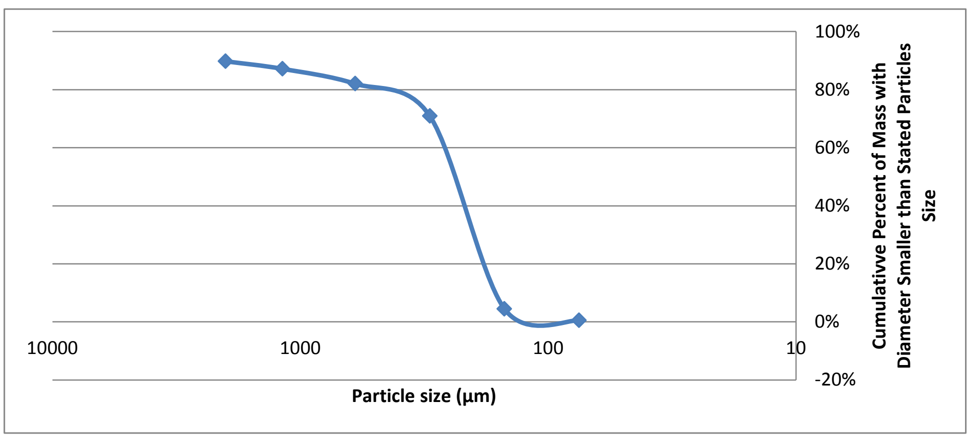


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-8 (4 feet bgs)	Soil Description:	
Sample Wt. (dry):	583.3 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	59.6	10%	523.7	90%	
16	1180	15.2	13%	508.5	87%	
30	600	30	18%	478.5	82%	
50	300	64.9	29%	413.6	71%	
100	150	387.4	96%	26.2	4%	
200	75	23.3	100%	2.9	0%	

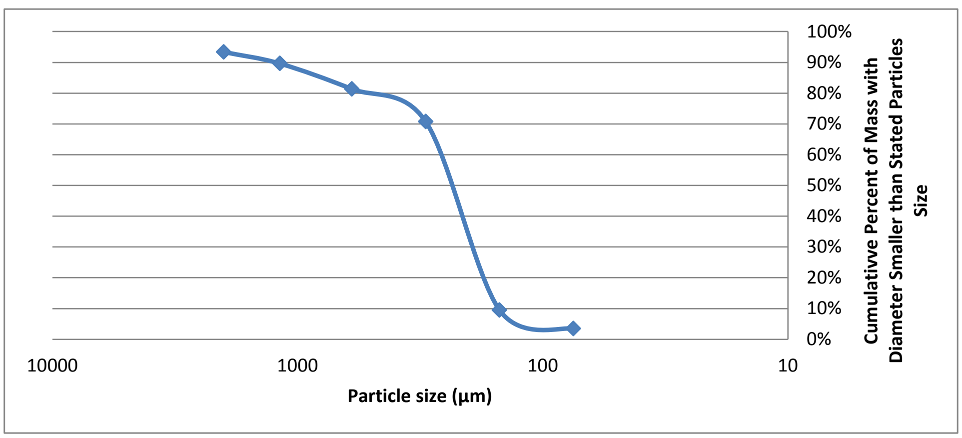


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-18 (10-12 feet bgs)	Soil Description:	
Sample Wt. (dry):	420.1 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	27.8	7%	392.3	93%	
16	1180	15.8	10%	376.5	90%	
30	600	34.8	19%	341.7	81%	
50	300	44.5	29%	297.2	71%	
100	150	257.3	91%	39.9	9%	
200	75	25.5	97%	14.4	3%	

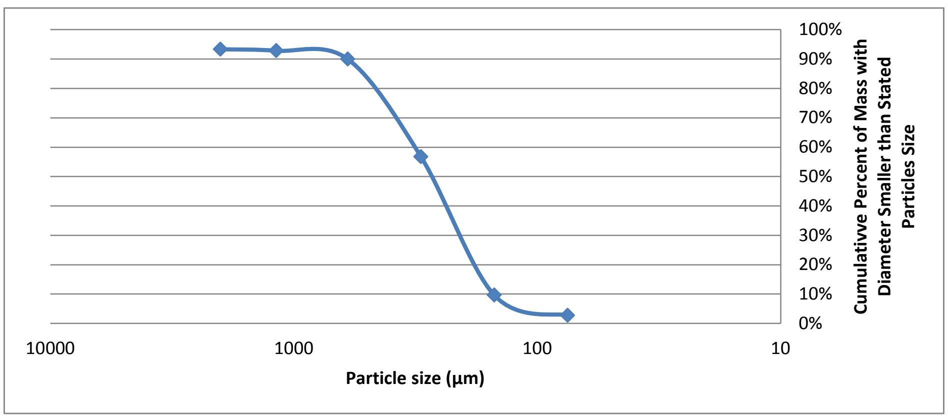


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	9/26/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-12 (5 feet bgs)	Soil Description:	
Sample Wt. (dry):	689.7 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	45.8	7%	643.9	93%	
16	1180	3.6	7%	640.3	93%	
30	600	19.7	10%	620.6	90%	
50	300	229.4	43%	391.2	57%	
100	150	324.8	90%	66.4	10%	
200	75	47.4	97%	19	3%	

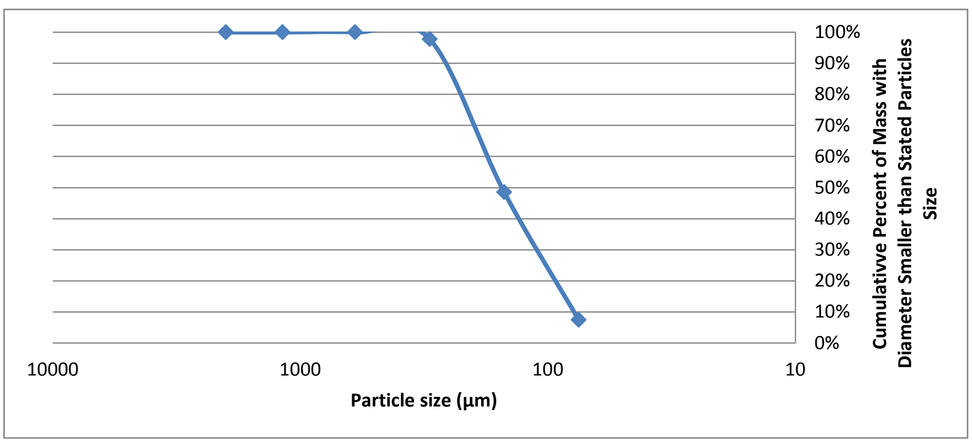


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	10/1/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-10 (26 feet bgs)	Soil Description:	
Sample Wt. (dry):	75.9 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	0	0%	75.92	100%	
16	1180	0.0	0%	75.92	100%	
30	600	0	0%	75.92	100%	
50	300	1.7	2%	74.22	98%	
100	150	37.4	52%	36.82	48%	
200	75	31.2	93%	5.62	7%	

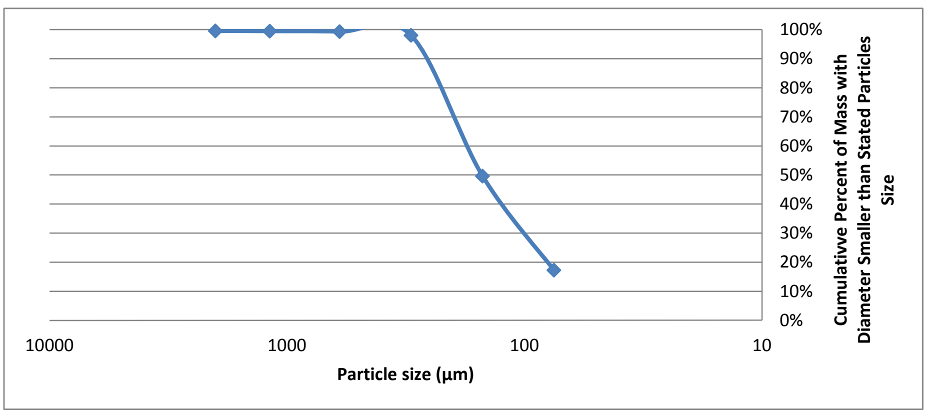


Sieve Analysis Test -ASTM C117 and C136

Job Name:	Trinidad ASBS		
Project Location:	Trinidad, California		
Job Number:	106311005	Date:	10/1/2012
AP#:		Tested By:	Anna Gower

Sample #:	SB-5 (30 feet bgs)	Soil Description:	
Sample Wt. (dry):	238.5 grams	Sample Location:	

Sieve Size	Particle Size (µm)	Grams Retained	Cumulative % Retained	Grams Passing	Cumulative % Passing	Comments
10	2000	1.04	0%	237.46	100%	
16	1180	0.2	1%	237.26	99%	
30	600	0.4	1%	236.86	99%	
50	300	3.1	2%	233.75	98%	
100	150	115.4	50%	118.35	50%	
200	75	77.2	83%	41.15	17%	



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