4.8 HAZARDS AND HAZARDOUS MATERIALS

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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?			✓	

IMPACT ANALYSIS

4.8.a Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Less Than Significant Impact. The Project proposes an AWTP that would treat brackish water to produce potable water. As described in detail in CDM PD Section 2.2, the AWTP would consist of multiple unit processes including microfiltration (MF) or ultrafiltration (UF), reverse osmosis (RO), advance oxidation process (AOP) utilizing ultraviolet (UV) light, and hydrogen peroxide (H_2O_2), and pre- and post-treatment chemical additions to the treated water before it is conveyed to RIW for recharge. The pre-treatment involves addition of ammonium hydroxide and sodium hypochlorite. The RO facility includes pre-treatment chemical addition (antiscalant and sulfuric acid for scale control). The UV disinfection process would include addition of hydrogen peroxide. The post-treatment strategy would include addition of calcium chloride and caustic soda. All solutions would be stored within the AWTP. All solutions would be delivered to the AWTP in closed containers and would be handled within the AWTP. Any potential spill would be entirely contained within the AWTP area, in compliance with the regulations discussed below.

The brine waste would be evaporated via natural evaporation as well as mechanical spray evaporators. Over time, the dissolved salt concentration in the pond would increase until it begins to precipitate from solution. The brine generated by the AWTP is not a hazardous material. Notwithstanding, the super-concentrated waste, whether liquid or solid, would be removed from the site for disposal. In concentrated slurry form, the waste would be pumped to trucks and hauled away for disposal at a licensed disposal site. In dried solids form, the solids accumulated on pond bottoms would be removed manually using shovels and barrels and disposed offsite at a licensed disposal site. See also Section 4.4, *Biological Resources*, for recommended mitigation.

The San Luis Obispo County Environmental Health Department (SLO EHD) is the Certified Unified Program Agency (CUPA) for the County. Monitoring of the AWTP with respect to the use of hazardous materials would be the primary responsibility of the SLO EHD, as well as the Central Coast Regional Water Quality Control Board (CCRWQCB). All hazardous materials or chemicals used at the AWTP would have to be filed on record with the SLO EHD (the designated CUPA) and California Department of Forestry (CDF), and would be routinely inspected to ensure that the materials are being stored, handled, and used in accordance with all applicable Federal, State, and local standards and regulations to reduce the potential for a hazardous materials incident. Transportation of all hazardous materials to/from the site would also be subject to compliance with all applicable Caltrans protocols. Additionally, facilities containing hazardous materials for transport, storage, or use would comply with all County, OSHA, Cal EPA, and U.S. EPA requirements.

The AWTP would incorporate leak and spill containment measures to minimize the risk of upset to both onsite employees and surrounding areas, as required by existing CUPA regulations. A typical design measure to minimize potential upset conditions involves storage of hazardous materials in containment structures with a 110 percent spill containment capability. These containment structures would be separated or divided from other chemicals to prevent mixing in case of accidental spillage. All storage tanks would be constructed of appropriate, non-reactive materials, compatible with the hazardous material supplier recommendations.

The AWTP operator would be required to develop hazardous waste management and safety plans in accordance with County, OSHA, and U.S. EPA requirements. In accordance with OSHA regulation 29 CFR 1910.119, the AWTP would require preparation of a Process Safety Management Program (PSM), which is designed to prevent/minimize the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. This PSM would provide the following preventative components:

- Employee participation plan;
- Process safety information;
- Process hazard analysis;
- Written operating procedures;
- Employee training requirements and written training programs;
- Inspection and maintenance program to document mechanical integrity;
- Preventative maintenance program;
- Contractor training requirements;
- Hot work cutting and welding permit procedures;
- Pre-startup safety review and management of change procedures;
- Compliance audit procedures;
- External emergency/non-emergency notification;
- Facilities training requirements; and
- Reportable quantities of onsite chemicals.

Because the AWTP would store hazardous materials onsite, it must also be in compliance with EPA Risk Management Planning (RMP) Rule 40 CFR 68, which would require the AWTP operator to register the facility with the EPA before onsite storage of hazardous chemicals.

The AWTP would require the transport of hazardous materials via truck. The transport of hazardous materials by truck is strictly controlled by State and Federal regulations. Hazardous materials transport would comply with all Caltrans (for truck transport) requirements to minimize potential spills and/or mishandling of hazardous materials.
The potential exists for hazardous materials to be accidentally released during operations. However, as previously noted, facilities that store, handle, or transport hazardous materials would be required to procure business plans and adhere to strict procedures enforced by agencies with jurisdiction over businesses or areas that routinely use or handle hazardous materials. During operations, all standards required by the SLO EHD, EPA, DTSC, and CDF would be implemented.

Compliance with the regulatory requirements described above would ensure that the Project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.

MITIGATION MEASURES

No mitigation is required.

4.8.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?

Less Than Significant Impact. Due to the use of chemicals in the processes described above, the potential exists for accidental release of these materials into the environment. However, compliance with the regulatory framework would ensure that the Project would not create a significant hazard to the public or the environment through the accidental release of hazardous materials. Refer to Response 4.8.a.

MITIGATION MEASURES

No mitigation is required.

4.8.c Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

No Impact. As concluded in Response 4.8.a, the Project would involve the routine transport and use of hazardous materials. However, the Project would not emit hazardous emissions and there are no existing or proposed schools within 0.25 miles of the Project site.

MITIGATION MEASURES

No mitigation is required.

4.8.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?

No Impact. The Project site is not included on a list of hazardous materials sites. Therefore, the Project would not be located on such a site.

MITIGATION MEASURES

No mitigation is required.

4.8.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?

No Impact. The Project site is located approximately 37 miles northwest of the San Luis Obispo County Regional Airport and is not located within the *Airport Land Use Plan for the San Luis Obispo County Regional Airport*. Therefore, the Project would not expose people working on the Project site to safety hazards associated with aircraft.

MITIGATION MEASURES

No mitigation is required.

4.8.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?

No Impact. The Rancho San Simeon Airport is located approximately one mile northwest of the Project site. Operating and maintaining the equipment would not require full time staff onsite, since the AWTP would operate automatically with no operators onsite. Up to two employees would visit the site daily to visually inspect and maintain the AWTP. Therefore, the Project would not expose people working on the Project site to safety hazards associated with aircraft.

MITIGATION MEASURES

No mitigation is required.

4.8.g Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

No Impact. San Simeon - Monterey Creek Road and Van Gordon Creek Road, which form the Project site's northern and western boundaries, are remote rural roads that do not form part of an emergency evacuation plan. Additionally, the proposed water facilities would be located entirely within the existing water facilities site. Therefore, the Project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.

MITIGATION MEASURES

No mitigation is required.

4.8.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?

Less Than Significant Impact. According to FRAP's Fire Hazard Severity Zones in SRA (State Responsibility Area) Map, the Project site is located in a "Moderate" fire hazard zone. Additionally, according to the County's Natural Hazard Disclosure (Fire) Map, the Project site is within a "wildland area[s] that may contain substantial forest fire risks and hazards."

Operating and maintaining the equipment would not require full time staff onsite, since the AWTP would operate automatically with no operators onsite. Up to two employees would visit the site daily to visually inspect and maintain the AWTP. The Project could expose structures to a significant risk involving wildland fires. The California Department of Forestry (CDF) and Fire Protection provides fire protection for State Responsibility Areas and, as the

County Fire Department, protects most unincorporated areas within the County. The Project would be subject to review by CDF/County Fire, which has an inspection process in place to ensure compliance with Fire and Safety Codes. Therefore, given the nature and scope of the proposed water facilities, and since they would be subject to review by CDF/County Fire, the Project would result in a less than significant impact involving the exposure of people or structures to a significant risk involving wildland fires.

MITIGATION MEASURES

No mitigation is required.

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4.9 HYDROLOGY AND WATER QUALITY

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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 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 storm water 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?				✓

REGULATORY FRAMEWORK

As part of Clean Water Act § 402, the U.S. Environmental Protection Agency (EPA) promulgated regulations under the National Pollution Discharge Elimination System (NPDES) program to control direct storm water discharges for construction activities disturbing one acre or more of land. In California, the State Water Resources Control Board (SWRCB) administers the NPDES permitting program and is responsible for developing NPDES permitting requirements. The NPDES program regulates industrial pollutant discharges, which include construction activities. The SWRCB works in coordination with the Regional Water Quality Control Boards (RWQCB) to preserve, protect, enhance, and restore water quality. The Project site is within jurisdiction of the Central Coast RWQCB (CCRWQCB).

Construction Activities

Dischargers whose projects disturb one or more acres of soil or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity Construction General Permit Order 2009-0009-DWQ, as administered through the SWRCB and associated RWQCBs. Construction activity subject to this permit includes clearing, grading and disturbances to the ground such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility. To obtain coverage for discharges under the General Construction Permit, dischargers are required to electronically file the Permit Registration Documents (PRDs), which include a Notice of Intent (NOI), Storm Water Pollution Prevention Plan (SWPPP), and other compliance related documents required by the General Permit and mail the appropriate permit fee to the State Water Board.

The Construction General Permit requires the development and implementation of a SWPPP. The SWPPP is required to include a site map(s), which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP is required to list Best Management Practices (BMPs) the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment, and other requirements. Section XIV of the Construction General Permit describes the elements a SWPPP must contain.

Project Operations

Pursuant to California Water Code Section 13260, a person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the waters of the state, other than into a community sewer system, is required to file with the appropriate RWQCB a report of the [waste] discharge (ROWD), containing the information that may be required by the RWQCB. Thus, any activities that involve discharges such as those to land, groundwater, or from diffused sources, are required to file a ROWD. The primary objective of a ROWD is to provide the technical information required by California Code of Regulations (CCR), Title 27, Division 2, *Solid Waste*, in support of a Waste Discharge Requirements (WDRs) Permit to protect California's surface, coastal, or ground waters (Water of the State). The WDR Permit is federally required under the Clean Water Act (CWA) and in California, the SWRCB and nine RWQCBs are responsible for implementation of WDR permits.

IMPACT ANALYSIS

4.9.a Violate any water quality standards or waste discharge requirements?

4.9.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?

4.9.f Otherwise substantially degrade water quality?

Less Than Significant Impact. San Simeon Creek and Van Gordon Creek traverse the southeastern and western portions of the Project site, respectively. Engineering TM Figure 2-9, *Brine Pond Section*, shows the existing evaporation pond.

The proposed emergency water Project is described in detail in Section 2.4, *Project Characteristics*. The Project's source water is the San Simeon Creek aquifer from existing Well 9P7. The extracted groundwater would be transferred to the proposed AWTP that would treat brackish water to produce potable water. To meet California

Department of Public Health (DPH) and Regional Water Quality Control Board (RWQCB) regulations, the treated AWTP product water would be re-introduced/pumped for injection into the groundwater basin so that it could then be pumped by the existing San Simeon well field. To inject the product water into the basin, a new potable water recharge injection well (RIW) is proposed at the existing potable water well-field. A stream of the AWTP product water would be pumped for discharge into the San Simeon creek via three injection wells (LIWs), in order to avoid potential impacts to the creek and downstream lagoon area. As an option to the three LIWs, the existing Well 9P7 discharge pipeline and discharge structure may be used to discharge directly into Van Gordon Creek or San Simeon Creek adjacent to the AWTP. The AWTP generated waste stream (brine) would be discharged through a pipeline from the AWTP to the existing Van Gordon pond, which would be lined with a primary and secondary impermeable liner and leak detection system. Mechanical spray evaporators are proposed to aid with brine evaporation in the lined pond. The Project would be capable of generating 400 gallons per minute (gpm) of new water, out of which 300 gpm would be used for emergency water supply to Cambria and 100 gpm would be used for habitat enhancement in the San Simeon Creek fresh water lagoons.

Short-Term Construction Impacts

Activities during the Project's construction phase include clearing, grading, and disturbances to the ground, such as stockpiling and excavation, which would result in short-term impacts to water quality. Dischargers whose projects disturb one or more acres of soil are required to obtain coverage under the General Construction Permit. The Project would disturb more than one acre, thus, is subject to compliance with the General Construction Permit requirements, as described above. Given the limited amount of ground disturbance associated with the Project, of less than 5.0 acres in total, and the timing of construction anticipated to occur during a period of low rainfall, the Project may qualify for a U.S. Environmental Protection Agency Small Construction Erosivity Waiver. Notwithstanding, the Project is subject to compliance with the relevant LCP Policies that address erosion and siltation: Coastal Streams LCP 20 requires that coastal streams and adjoining riparian vegetation be protected; LCP 21 requires evaluation of erosion and runoff concerns for development adjacent to a coastal stream; LCP 23 requires that the RWQCB and the County ensure that the beneficial use of coastal stream waters is protected; LCP 28 requires that a buffer setback zone be established between any new development and the upland edge of riparian habitats; and Hazards LCP 2 requires that new development ensure structural stability while not creating or contributing to erosion. The Project is subject to compliance with CZLUO Chapter 23.05, which establishes standards for the preparation of sites for development and construction activities to protect against soil erosion. Specifically, CZLUO Sections 23.05.022 through 23.05.039 establish standards for grading and excavation activities to protect against erosion and the sedimentation of water courses. CZLUO Section 23.07.174 establishes standards intended to preserve and protect the natural hydrological system and ecological functions of coastal streams. Compliance with the relevant LCP Policies would be achieved through compliance with the NPDES, BCO, and CZLUO. Following compliance with the NPDES, LCP, and CZLUO regulatory requirements, the Project's construction-related impacts to water quality would be less than significant.

Long-Term Operations – LIW Option

A stream of the AWTP product water would be pumped southwest of the AWTP for discharge into the San Simeon Creek via three LIWs. The AWTP generated waste stream (brine) would be evaporated in the existing Van Gordon Reservoir, which would be lined with an impermeable liner system to serve as the evaporation pond for this Project. The primary and secondary liners with leak detection would provide containment of brine to protect soil and groundwater beneath. The brine evaporation would be aided with mechanical spray evaporators.

Pursuant to California Water Code Section 13260, because the Project proposes activities that involve discharges to land and groundwater (e.g., the LIWs and the Van Gordon evaporation pond), the Project is required to file a ROWD with the CCRWQCB. The ROWD would provide the technical information in support of a WDRs Permit, in order to protect nearby surface, coastal, and ground waters. The CCRWQCB would issue the WDR Permit for the LIWs and the Van Gordon evaporation pond. The liquid waste (brine) that would be stored at the Van Gordon Reservoir is classified by the RWQCB as a Special Waste, which prohibits any discharge of this waste material to Waters of the

State in excess of background levels. The ROWD would, at a minimum, identify the Project's expected discharge volumes into the evaporation pond, the expected chemical constituents of the discharge, and the concentrations of those constituents. The constituents identified would consider both the source water from Well 9P7 and from Project operations (e.g., AWTP operations). The ROWD would identify all measures to be implemented to construct a zero discharge facility as required by Title 27. This zero discharge facility would prevent mobilization of any constituents in the brine into nearby creeks during storm events and would include the installation of an impermeable liner, a leachate collection and removal system (LCRS), and a vadose zone monitoring system. The primary liner and textured drain liner materials would be impermeable. The LCRS would include a perforated conductor pipe and trench along the pond bottom terminating into a collection sump. The LCRS would be designed to maintain less than 1.0 foot of head on the secondary liner. The LCRS sump would have a surface entry pipe for monitoring and removal of any accumulated leach.

Long-Term Operations – Direct Discharge Existing Pipeline/Structure Option

As an option to utilizing LIWs, the existing discharge piping and structure of Well 9P7 may be utilized to discharge AWTP product water directly into Van Gordon Creek or San Simeon Creek adjacent to the AWTP. The MF treated side stream water would be conveyed using an existing on-grade laid pipeline to the shallow LIWs.

Currently, the existing 8-inch PVC discharge pipeline and surface discharge structure are used to discharge pumped groundwater from existing Well 9P7 to Van Gordon Creek. The existing pipeline is used intermittently when water table at the potable water supply well area drops to 1.0 foot above a monitoring well, which is located between the existing ponds and potable water well field. The pump capacity is approximately 700 gpm. This current discharge is permitted through Waste Discharge Requirements for Cambria Community Services District Wastewater Treatment Plant Order No. 01-100 issued by the CCRWQCB in December 2012. This current Order regulates the discharge of treated wastewater to land. Specifically, effluent from CCSD's WWTP is pumped to the onsite pond system for evaporation. The Order includes Discharge Specifications pertaining to effluent limitations, groundwater limitations, and wastewater quality, among other limitations. Revisions to this existing Order would be required, in order for the proposed Project to use the existing discharge piping and structure to discharge directly into Van Gordon Creek.

In addition to the RWQCB requirements specified above, the Project is subject to compliance with the relevant LCP Policies that address long-term water quality: LCP 1 addresses the preservation of groundwater basins; LCP 2 addresses water extractions, impoundments, and other water resource developments; LCP 16 addresses development adjacent to coastal wetlands; LCP 20 requires that coastal streams and adjoining riparian vegetation be protected; LCP 21 requires evaluation of erosion and runoff concerns for development adjacent to a coastal stream; and LCP 23 requires that the RWQCB and the County ensure that the beneficial use of coastal stream waters is protected. Review of the Project through the established regulatory framework would ensure the ROWD contains the necessary technical information in support of a WDR Permit to protect the nearby surface, coastal, and ground waters (Waters of the State). Compliance with the LCP Policies outlined above would be achieved through compliance with CZLUO and CCRWQCB requirements. Compliance with the established regulatory framework would ensure the Project would result in a less than significant impact involving long-term water quality.

EXISTING REGULATIONS

Local Coastal Program Policies:

Coastal Watersheds

LCP 1 Preservation of Groundwater Basins. The long-term integrity of groundwater basins within the coastal zone shall be protected. The safe yield of the groundwater basin, including return and retained water, shall not be exceeded except as part of a conjunctive use or resource management program which assures that the biological productivity of aquatic habitats are not significantly adversely impacted.

LCP 2 Water Extractions. Extractions, impoundments, and other water resource developments shall obtain all necessary county and/or state permits. All pertinent information on these uses (including water conservation opportunities and impacts on in-stream beneficial uses) will be incorporated into the data base for the Resource Management System and shall be supplemented by all available private and public water resources studies available. Groundwater levels and surface flows shall be maintained to ensure that the quality of coastal waters, wetlands, and streams is sufficient to provide for optimum populations of marine organisms, and for the protection of human health.

Wetlands

LCP 16 Adjacent Development. Development adjacent to coastal wetlands shall be sited and designed to prevent significant impacts to wetlands through noise, sediment or other disturbances. Development shall be located as far away from the wetland as feasible, consistent with other habitat values on the site.

Coastal Streams

LCP 20 Coastal Streams and Riparian Vegetation. Coastal streams and adjoining riparian vegetation are environmentally sensitive habitat areas and the natural hydrological system and ecological function of coastal streams shall be protected and preserved.

LCP 21 Development in or Adjacent to a Coastal Stream. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 23 County and State Review of Coastal Stream Projects. The State Water Resources Control Board and the County shall ensure that the beneficial use of coastal stream waters is protected, for projects over which it has jurisdiction. For projects which do not fall under the review of the State Water Resources Control Board, the county (in its review of public works and stream alterations) shall ensure that the quantity and quality surface water discharge from streams and rivers shall be maintained at levels necessary to sustain the functional capacity of streams, wetland, estuaries and lakes.

Hazards

LCP 2 Erosion and Geologic Stability. New development shall ensure structural stability while not creating or contributing to erosion or geological instability.

San Luis Obispo County Building and Construction Ordinance:

In California, construction regulations consist of the California Building Code (CBC) and any additions or modifications to the CBC implemented by the local government. The San Luis Obispo County Building and Construction Ordinance (Title 19 of the San Luis Obispo County Code) (BCO) was established and adopted to protect and promote the public health, safety, and welfare. This ordinance is intended to regulate the design and construction of buildings and structures through basic standards for site preparation, erosion and sedimentation control, construction activities, quality of materials, occupancy classifications, the location and maintenance of buildings and structures and certain equipment associated with buildings and structures.

Coastal Zone Land Use Ordinance Standards:

Chapter 23.05 (Site Development Standards). This Chapter establishes standards for the preparation of sites for development and construction activities, to protect the health, safety and welfare of persons living on or near a project site by protecting against unwarranted or unsafe grading, or soil erosion resulting from grading; by defining appropriate circumstances for tree removal; by providing for adequate drainage and fire protection facilities; and by identifying appropriate standards for other aspects of site development.

Sections 23.05.022 through 23.05.039. Establish standards for grading and excavation activities to minimize hazards to life and property; protect against erosion and the sedimentation of water courses; and protect the safety, use and stability of public rights-of-way and drainage channels. Additional standards for grading within a Sensitive Resource Area are in Sections 23.07.160 et seq.[1]

Section 23.07.174 (Streams and Riparian Vegetation). Coastal streams and adjacent riparian areas are environmentally sensitive habitats. The provisions of this section are intended to preserve and protect the natural hydrological system and ecological functions of coastal streams.

a. Development adjacent to a coastal stream. Development adjacent to a coastal stream shall be sited and designed to protect the habitat and shall be compatible with the continuance of such habitat.

MITIGATION MEASURES

No mitigation is required.

4.9.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)?

Less Than Significant Impact. All of Cambria's potable water is supplied from groundwater wells in the San Simeon and Santa Rosa Creek aquifers. The San Simeon and Santa Rosa aquifers are relatively shallow and porous, with the groundwater levels typically recharged every year during the rainy season. With pumping, groundwater levels generally exhibit a consistent pattern of high levels during the wet season, steady decline during the dry season, and rapid rise when the wet season resumes.

To minimize potable groundwater losses at the aquifer and ocean interface, treated wastewater effluent from CCSD's WWTP is percolated into the San Simeon Creek aquifer downstream from its production wells. This practice also helps prevent saltwater intrusion into the freshwater water aquifer. If the groundwater level drops too far, treated effluent and seawater could migrate toward the water supply wells, deteriorating the water quality and potentially rendering the freshwater non-potable. The CCSD operations maintain a positive differential between the up-gradient groundwater levels at its potable well field and the down-gradient wastewater effluent percolation ponds. During later parts of the summer dry season, and depending upon the prior year's precipitation, the CCSD may occasionally operate with a negative gradient, and will periodically pump groundwater from its percolation pond area, in order to control this differential.

As detailed in Section 2.0, *Project Description*, the Project proposes to withdraw 400 gpm of water through existing Well 9P7, from which 300 gpm would be used for emergency water supply to the Cambria community and 100 gpm would be reinjected to avoid potential impacts to the San Simeon Creek and down gradient fresh water lagoon.

[1] SRAs are addressed in CZLUO Section 23.07.170- not 23.07.160; see Section 4.4, *Biological Resources*.

The Cambria Emergency Water Supply Project San Simeon Creek Basin Groundwater Modeling Report (GMR) (CDM Smith, May 14, 2014) was prepared to support evaluation of the basin water management alternatives to develop additional water supplies for CCSD to meet the emergency conditions; see Appendix D, *Groundwater Modeling Report*. The analysis of alternatives presented in the report compared modeled residence times for recharged water with regulatory requirements for indirect potable reuse. In addition, the potential impacts of the emergency water supply alternatives on San Simeon Creek and the fresh water lagoon areas were evaluated to allow for the development of avoidance and mitigation measures.

GMR Section 6.4, *Emergency Alternative 4 (Indirect Potable Reuse)*, addresses an alternative that is designed to maximize recovery of the percolated secondary treated wastewater while maintaining a mound to avoid movement of percolated waste water toward the existing well field; see GMR Figure 6-5. In the absence of this alternative, pumping of the gradient control well 9P7, with discharge of fresh water to the lagoon would be required in order to avoid inducing flow of secondary treated effluent from the percolation pond area back toward the existing well field. This would result in a significant loss of fresh water resource in the groundwater basin, since losses to the ocean would increase. Emergency Alternative 4 operations are generally consistent with the proposed Project's operations; see GMR page 6-2. The GSR provides a conservative assessment that assumes the emergency operations would continue for over one year, assuming that no significant runoff occurs in San Simeon Creek. Since this alternative met the selection criteria, detailed simulation results are presented in the GMR.

GMR Figure 6-13 shows the simulated water level after one year of operations during which time no runoff was assumed, illustrating the mounding at the recharge well with radial flow along the aquifer extent both toward the CCSD supply wells and toward the percolation ponds. A cone of depression develops around well 9P7 that extends to the downgradient area beneath the fresh water lagoon. The decrease in groundwater levels adjacent to the fresh water lagoon will increase seepage from the lagoon to groundwater in the eastern portion of the lagoon. During typical climatic conditions, water levels in the groundwater basin remain high enough that groundwater discharges to the lagoon, however, during simulated emergency operations, this groundwater discharge to the lagoon will no longer occur.

In order to maintain water in the fresh water lagoon, the Project proposes to reinject 100 gpm of extracted water into the aquifer adjacent to the eastern extent of the lagoon. This Project design feature was simulated and assessed in the model. GMR Figure 6-15 shows the simulated shallow water table adjacent to the fresh water lagoon and indicates that for an extended drought condition, the injection wells may not be able to maintain a water level that would sustain groundwater discharge to the lagoon. The area of the lagoon under typical conditions is approximately 4.0 acres, based on aerial photographs. Direct discharge of 100 gpm to the lagoon would correspond to adding a depth of 0.11 feet per day (ft/day) over the entire area of the lagoon. Recent monitoring of tidal fluctuations in water levels in the lagoon indicate that a diurnal amplitude of approximately 1.5 inches is observed, which indicates that the sediments in the lagoon limit connectivity with groundwater, so seepage losses are expected to be less than the 0.11 ft/day that would be added.

GMR Figure 6-16 shows the simulated basin storage depletion and ocean inflows and outflows on a monthly basis. The simulation indicates that the majority of the production from the CCSD well field, Well 9P7, and existing irrigation wells comes from reductions in storage in the aquifer, resulting in water level declines. In the absence of recharge, water will drain from the upper portion of the basin toward pumping wells and the ocean. During ten months of simulated emergency operations, a net outflow of fresh water to the ocean would continue to occur, with a reversal of flow indicating movement of ocean water back into the aquifer after this time. This salt water wedge would advance in the deeper portion of the aquifer due to the density difference between fresh water and saline ocean water. Simulations indicate that during the one year operation period that the salt water wedge would not advance to the Well 9P7 location. GMR Figure 6-17 shows total dissolved solids (TDS) profile from well samples, showing the increase in TDS that occurs toward the ocean. This profile indicates that only limited salt water intrusion in the lower portion of the aquifer occurs, since there is a net outflow of fresh water due to current operations of the treated wastewater percolation ponds. GMR Figure 6-18 shows the simulated TDS at Well 9P7, which indicates that TDS will

not increase due to the pumping at this location during the duration that was simulated. This is due to continued flow of groundwater from the upper basin and recirculation of very low TDS water that is injected between the percolation ponds and the CCSD well field.

As previously mentioned, emergency water supply Alternative 4 is generally consistent with the proposed Project operations. Based on the modeling simulations, the GMR concludes that emergency water supply Alternative 4 would be feasible, although there would be significant recirculation of the highly treated water. A key element of this feasibility is the use of an injection well between the CCSD well field and the percolation ponds. Use of this approach would allow maintenance of a gradient that would protect the well field from impacts from the percolated effluent and brackish water present in the lower basin. Emergency water supply Alternative 4 increases sustainability of the water supply under the current drought conditions, since the previously lost percolated effluent is captured, highly treated, and produced for water supply after appropriate residence time in the aquifer. Pumping from Well 9P7 would also be beneficially used after treatment to protect the CCSD well field from treated wastewater and brackish water in the lower part of the basin through maintenance of a mound. Without implementation of this alternative, gradient control pumping at Well 9P7 and its discharge would result in significant losses of fresh water in the basin and greatly reduced production rates from the CCSD well field. The brackish water that would be pumped from the basin for treatment would be diluted with percolated secondary effluent and a portion of highly treated water that is injected would maintain a protective gradient between the percolation ponds and the potable water well field. Use of the injection well to create a mound near the freshwater lagoon would have limited benefits later in the season, as basin water levels are drawn down below the channel invert, precluding discharge of the mounded groundwater to the lagoon. Mitigation would be more effective by discharging the treated water directly in the open channel, as proposed by the Project's option to using the three LIWs, which is to use the existing Well 9P7 discharge pipeline and discharge structure to discharge directly into Van Gordon Creek adjacent to the AWTP. Overall, the GMR's modeling analysis indicates that enhancing water supplies for both emergency and long-term conditions is feasible in the San Simeon Creek Basin.

The Project is subject to compliance with the relevant LCP Policies that address groundwater resources: LCP 1 addresses the preservation of groundwater basins; LCP 2 addresses water extractions, impoundments, and other water resource developments; and LCP 20 requires that coastal streams and adjoining riparian vegetation be protected. Review of the Project through the established regulatory framework would ensure the ROWD contains the necessary technical information in support of a WDR Permit to protect the nearby surface, coastal, and ground waters (Waters of the State). As shown through the GSR's findings, the Project would comply with the LCP Policies outlined above. The Project would enhance recharge to the groundwater basin, since fresh water that is currently lost to the ocean from operation of the treated waste water percolation ponds would be captured, highly treated, and recharged to the basin to maintain CCSD well production and protective hydraulic gradients. The Project would also result in a lesser decline in groundwater basin water levels than continuing current operations, since water from well 9P7 would be beneficially used for recharge, rather than lost as discharge to the ocean.

Overall, the Project includes provisions for the replenishment of extracted groundwater to avoid a substantial drop in production of pre-existing nearby wells; hence, the Project would result in a less than significant impact involving groundwater supplies and no mitigation is required.[2]

The Project proposes to withdraw 400 gpm of water through existing Well 9P7 (plus sufficient volume to make up for brines generated in the treatment process). Reinjection of 300 gpm of highly treated water for indirect potable reuse after appropriate residence time in the aquifer and gradient control would occur at the proposed recharge well, while 100 gpm would be discharged to San Simeon Creek to support the fresh water lagoon. The Project would result in a less than significant impact regarding depletion of existing groundwater supplies, given the current severe drought

[2] As addressed in Section 4.4, Mitigation Measure BIO-6 proposes an Adaptive Management Program (AMP) to address potential impacts to biological resources (riparian habitat/species) in the San Simeon Creek Lagoon, San Simeon Creek, and Van Gordon Creek. Mitigation Measure BIO-6 provides for an increase in the proposed rate of groundwater replenishment (i.e., increase from 100 gpm to 150 gpm), if/as necessary to avoid significant impacts to those biological resources.

condition. The CCSD is proposing the Cambria Emergency Water Supply Project in response to the current severe drought condition that has placed the water supply for Cambria community in immediate jeopardy. As a result of this condition, the CCSD Board of Directors declared on January 30, 2014 a Stage 3 Water Shortage Emergency for Cambria, the most stringent of three water shortage levels. Reflecting the severity of the severe drought conditions experienced in Cambria community as well as the rest of the state of California, on January 17, 2014, Governor Jerry Brown declared a drought emergency for the State of California, and on March 11, 2014, the San Luis Obispo (SLO) County Board of Supervisors proclaimed a local emergency due to the County's drought conditions. The Governor issued a subsequent drought declaration on April 24, 2014. CCSD anticipates continued water shortages and drought conditions over the course of the next 20 years, as a result of climate change impacts, and anticipates the likely need for use of the emergency water supply facilities in 8 to 10 of the next 20 years. Moreover, the Project does not involve construction of new homes or land uses that would create a demand for water. Therefore, the Project would not substantially deplete groundwater supplies.

EXISTING REGULATIONS

Local Coastal Program Policies: See LCP 1, LCP 2, and LCP 20 above.

MITIGATION MEASURES

No mitigation is required.

4.9.c Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

4.9.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?

Less Than Significant Impact. San Simeon Creek and Van Gordon Creek traverse the southeastern and western portions of the property, respectively. Engineering TM Figure 2-9, *Brine Pond Section*, shows the existing Van Gordon Reservoir.

The Project does not involve development of vast impervious surface areas (such as roadways, rooftops, or parking lots) that would increase runoff or substantially alter the existing drainage patterns. A nominal increase in onsite impervious surface areas would occur due to the proposed AWTP. As shown on Exhibit 2-6, *Project Overview*, the water facilities are proposed outside of the creek corridors. Additionally, although the Project proposes to rehabilitate/modify the existing Van Gordon Reservoir for disposal of the RO brine (by adding impermeable liners, a leachate collection/removal system (LCRS), a vadose zone monitoring system, and mechanical spray evaporators), only nominal earthwork would be required. Exhibit 9, *Brine Pond Plan*, shows the proposed Van Gordon percolation pond. The Project proposes to: demolish/regrade the existing spillway along the pond's southern berm to provide a uniform top of slope elevation around the pond; and grade the bottom of the pond for installation of the proposed liners, LCRS, and monitoring system. These proposed improvements would not substantially alter the Project site's drainage patterns or alter the course of San Simeon or Van Gordon Creeks. Further, since the Project is designated Flood Hazard (FH) Combining Designation, the Project is subject to compliance with LCP Policy 3, which requires that the County conduct a detailed review of development; see also Response 4.9.h below. The Project would also be subject to compliance with CZLUO Chapter 23.05, which establishes standards for the preparation of sites, in order to provide adequate drainage, among other objectives. Compliance with CZLUO Section 23.07.064, which requires preparation and approval of a Drainage Plan where any portion of a site is located within an FH Combining Designation, would also be required. Following compliance with the LCP and CZLUO, the Project would result in a less than significant impact regarding alterations to the Project site's existing drainage pattern.

EXISTING REGULATIONS

Local Coastal Program Policies:

LCP 3 Development Review in Hazard Areas. The County shall require a detailed review of development proposed within the geologic study area and flood hazard combining designations as indicated on the Land Use Element maps for the coastal zone. The review shall be performed by a qualified registered and/or certified engineering geologist and shall be adequately detailed to provide recommendations and conclusions consistent with this plan. Residential, commercial and industrial development shall be prohibited within the l00 year floodplain (one percent (1%) chance of inundation in any year) as delineated in the Flood Hazard combining designation except for those areas within an urban reserve line.

Coastal Zone Land Use Ordinance Standards:

Chapter 23.05 (Site Development Standards). This Chapter establishes standards for the preparation of sites for development and construction activities, to protect the health, safety and welfare of persons living on or near a project site by protecting against unwarranted or unsafe grading, or soil erosion resulting from grading; by defining appropriate circumstances for tree removal; by providing for adequate drainage and fire protection facilities; and by identifying appropriate standards for other aspects of site development.

Section 23.07.064 - Flood Hazard Area Permit and Processing Requirements. Drainage Plan approval is required where any portion of the proposed site is located within a Flood Hazard combining designation, in addition to all other permits required by this title, state, and federal law.

MITIGATION MEASURES

No mitigation is required.

4.9.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?

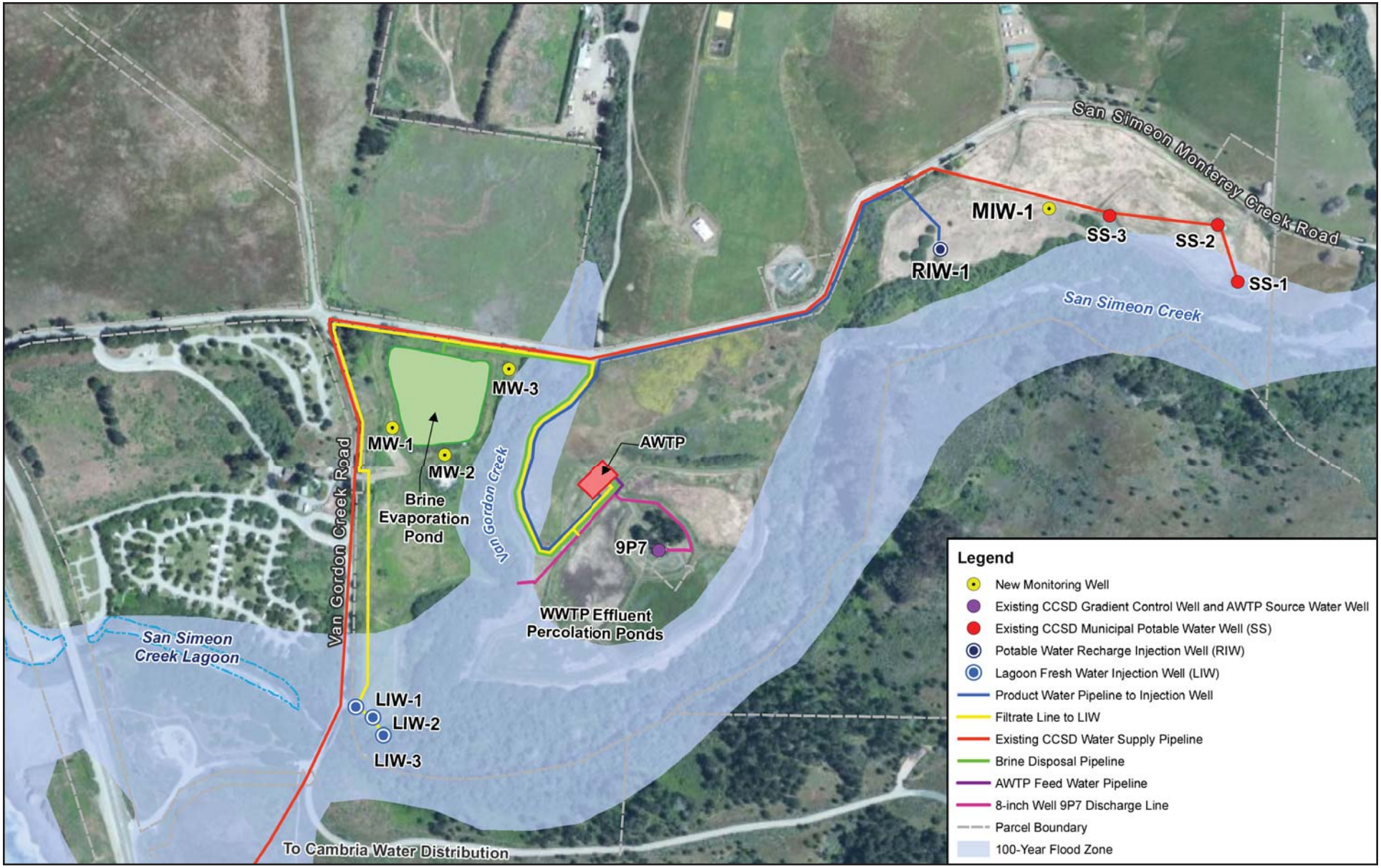
No Impact. The Project involves construction and operation of emergency water facilities- no housing is proposed. Therefore, the Project would not place housing within a 100-year flood hazard area.

MITIGATION MEASURES

No mitigation is required.

4.9.h Place within a 100-year flood hazard area structures which would impede or redirect flood flows?

Less Than Significant Impact. General Plan Safety Element Map 5, *FEMA-FIRM Flood Hazard Map*, which depicts the unincorporated County areas subject to inundation from a 100-year storm event, indicates portions of the Project site are located within a flood hazard area. The Project site is designated Flood Hazard (FH) Combining Designation; see the Coastal Zone North Coast Planning Area Rural Combining Designation Map. Exhibit 4.9-1, *FEMA 100-year Flood Zones*, shows the onsite flood hazards zones and indicates proposed Well LIW and segments of the brine disposal pipeline and product water pipeline to injection wells are within a flood hazard zone. Given their scope and nature, it is not anticipated the proposed water facilities would impede or redirect flood flows. The Project would be subject to compliance with the relevant LCP Policies that address flood hazards: LCP 1 requires that new development be designed to minimize risks to property subject to flood conditions; and LCP 3 requires that the



Source: CDM Smith, June 2014.

NOT TO SCALE

RBF CONSULTING A Baker Company

06/14 • JN 141290

CAMBRIA EMERGENCY WATER SUPPLY PROJECT
INITIAL STUDY/MITIGATED NEGATIVE DECLARATION

FEMA 100-Year Flood Zones

Exhibit 4.9-1

County conduct a detailed review of development proposed within FH areas. Further, pursuant to CZLUO Section 23.07.062, all uses proposed within a FH Combining Designation are subject to standards specified in CZLUO Sections 23.07.064 through 23.07.066. Namely, CZLUO Section 23.07.064 requires Drainage Plan approval where any portion of the site is within a FH Combining Designation, and CZLUO Section requires that the development be constructed consistent with the standards set forth in CZLUO Section 23.07.066, which specifically address both general and storage/processing construction standards and certification of compliance with elevation requirements.

Therefore, following compliance with CZLUO requirements, which include preparation of a Drainage Plan, the Project would result in a less than significant impact involving the placement of structures within a flood hazard area.

EXISTING REGULATIONS

Local Coastal Program Policies:

Hazards

LCP 1 New Development. All new development proposed within areas subject to natural hazards from geologic or flood conditions (including beach erosion) shall be located and designed to minimize risks to human life and property……

LCP 3 Development Review in Hazard Areas. The County shall require a detailed review of development proposed within the geologic study area and flood hazard combining designations as indicated on the Land Use Element maps for the coastal zone. The review shall be performed by a qualified registered and/or certified engineering geologist and shall be adequately detailed to provide recommendations and conclusions consistent with this plan. Residential, commercial and industrial development shall be prohibited within the l00 year floodplain (one percent (1%) chance of inundation in any year) as delineated in the Flood Hazard combining designation except for those areas within an urban reserve line.

CZLUO Standards:

Section 23.07.060 - Flood Hazard Area (FH). The Flood Hazard combining designation is applied to areas where terrain characteristics would present new developments and their users with potential hazards to life and property from potential inundation by a 100-year frequency flood or within coastal high hazard areas. These standards are also intended to minimize the effects of development on drainage ways and watercourses.

Section 23.07.062 - Applicability of Flood Hazard Standards. All uses proposed within a Flood Hazard combining designation are subject to the standards of Sections 23.07.064 through 23.07.066, except:

a. Temporary uses: With the approval of the Director of Public Works, the of Planning and Building Director may authorize construction or placement of a temporary structure or use within a Flood Hazard area pursuant to the required land use permit without meeting these standards, provided that the structure or use will not be in place from October 15, to April 15.

b. Emergency work: Emergency work may be undertaken where necessary to preserve life or property. Within 48 hours after commencement of such work, the Director of Public Works is to be notified and an application filed with the Department of Planning and Building in compliance with the provisions of Section 23.07.064.

Section 23.07.064 - Flood Hazard Area Permit and Processing Requirements. Drainage Plan approval is required where any portion of the proposed site is located within a Flood Hazard combining designation, in addition to all other permits required by this title, state, and federal law.

Section 23.07.065 - General Hazard Avoidance:

a. New Development in Flood Hazard Areas. New structural development, including expansions, additions and improvements to existing development, shall be located outside of the flood hazard areas to the maximum extent feasible. All new structural development located in a flood hazard areas, including expansions, additions, improvements, and repairs to existing development, shall be constructed consistent with the standards set forth in Section 23.07.066.

Section 23.07.066 - Construction Standards:

a. Construction, general: See Standards 1 – 12.

b. Storage and Processing: The storage or processing of materials that in time of flooding are buoyant, flammable, or explosive; that could be injurious to human, animal, or plant life; or that may unduly affect the capacity of the floodway or unduly increase flood heights is not permitted. Storage of other material or equipment may be allowed if not subject to major damage by floods and if firmly anchored to prevent flotation, or if readily removable from the area within the time available after flood warning.

d. Certification of Compliance. The following certifications shall be filed with the Building Official prior to final building inspection:

(1) Upon completion of any structure within a flood hazard combining designation, compliance with elevation requirements shall be certified by a registered civil engineer or licensed land surveyor. Such certification shall include as a minimum the elevation of the lowest floor. If the structure has been flood-proofed in conformance with Section 23.07.066a(11) above, the certification shall include the elevation to which the structure has been flood-proofed. Elevations shall be based on the National Geodetic Vertical Datum of 1929.

(2) Where flood-proofing is used, a registered civil engineer or architect shall certify that the flood-proofing methods are adequate to withstand the flood depths, pressures, velocities, impact and uplift forces and other factors associated with the 100-year flood.

MITIGATION MEASURES

No mitigation is required.

4.9.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?

No Impact. Operating and maintaining the equipment would not require full time staff onsite, since the AWTP would operate automatically. Additionally, there are no levees or dams located in the Project's vicinity. Therefore, the Project would not expose people or structures to a significant risk involving flooding as a result of the failure of a levee or dam.

MITIGATION MEASURES

No mitigation is required.

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4.10 LAND USE AND PLANNING

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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?				✓

IMPACT ANALYSIS

4.10.a Physically divide an established community?

No Impact. The Project involves construction and operation of water facilities entirely within an existing CCSD public utility site. Also, the Project site is located in a rural area; there are no established communities located in the Project vicinity. Therefore, the Project would not physically divide an established community.

MITIGATION MEASURES

No mitigation is required.

4.10.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?

Less Than Significant Impact. The Project is located within jurisdiction of the County of San Luis Obispo (County) and it's Coastal Zone. Therefore, the Project is subject to County Land Use Element and Coastal Act conditions. In the Coastal Zone, the County's Land Use Element is made up of four parts: Official Maps; Framework for Planning; Area Plan; and Coastal Plan Policies. The County's Local Coastal Program (LCP) is part of the County General Plan and Zoning Ordinance, and applies to those areas lying within the Coastal Zone. The County's LCP also functions as the mandatory General Plan Circulation and Land Use Elements. The Coastal Zone Land Use Ordinance (CZLUO) supplements the Coastal Zone Land Use Element (LCP) and provides provisions typically found in zoning ordinances (i.e., permit and appeal requirements, site design, development and operational standards, and enforcement provisions).

OFFICIAL MAPS

The Project site is located in the North Coast (NC) Planning Area. The *Coastal Zone North Coast Planning Area Rural Land Use Category Map*[1] separates the NC Planning Area into land use categories, which determine the

[1] County of San Luis Obispo Website, http://www.slocounty.ca.gov/planning/zoning/Map_Image_Download_Center/Land_Use_Maps.htm, Accessed May 15, 2014.

allowable uses for every piece of property, including the maximum density and intensity of potential development. As shown on the Land Use Category Map, the Project site is designated Agriculture.

The *Coastal Zone North Coast Planning Area Rural Combining Designation Map*[2] assigns Combining Designations to NC areas containing hazards, sensitive resource areas, environmentally sensitive habitat areas, historic and archaeologically sensitive areas, and public facilities. As shown on the Combining Designation Map, portions of the Project site are assigned the following Combining Designations:

- Geologic Study Area (GSA);
- San Simeon Creek Flood Hazard (FH);
- Sensitive Resource Area (SRA);
- Environmentally Sensitive Habitat, Terrestrial Habitat (ESH-TH); and
- Environmentally Sensitive Habitat, Coastal Creek (ESH-CC).

Additionally, the Project site (and all of the NC Planning Area) is assigned Local Coastal Program (LCP) Combining Designation.

FRAMEWORK FOR PLANNING

Framework for Planning serves as an organizational document, linking land use, resource management, and circulation. Additionally, the Framework for Planning contains definitions of the land use categories and the land uses for the County's Coastal Zone.

Framework for Planning Chapter 6, *Land Use Categories & Allowable Uses*, addresses land use categories. The land use categories identify areas for similar and compatible land uses, and provide a basic order for development, while allowing a range of uses. As noted above, the Land Use Category Map indicates the Project site is designated Agriculture (AG). The following is noted regarding the AG category:

> *In many instances, coastal agricultural lands, such as areas for cattle grazing and row crops, display a rural and open character, and therefore have open space values. As used in this discussion, 'open space' is meant in the context of the Williamson Act.*[3]

The Project site contains CCSD water facilities, thus, is consistent with the "Public Utility Facilities [J5]" land use definition, as follows:

> *Public Utility Facilities [J5]: Fixed-base structures and facilities serving as junction points for transferring utility services from one transmission voltage to another or to local distribution and service voltages. These uses include any of the following facilities: electrical substations and switching stations; telephone switching facilities; natural gas regulating and distribution facilities; public water system wells, treatment plants and storage; and community wastewater treatment plants, settling ponds and disposal fields.*

Per Table O of the *Coastal Zone Framework for Planning*, Public Utility Facilities on sites designated AG category are "S-13" status. The S-13 status indicates the land use is a special use, allowable subject to special standards and/or processing requirements, unless otherwise limited by a specific planning area standard. The special standards that apply to Public Utility Facilities are outlined CZLUO Section 23.08.280, *Transportation, Utilities, and Communication*; refer to the *CZLUO Chapter 23.08, Special (S) Uses*, Section below. Additionally, CZLUO Section 23.04.050, *Non-Agricultural Uses in the Agriculture Land Use Category*, establishes permit requirements and standards for non-agricultural uses in the Agriculture category; refer to the *CZLUO Section 23.04.050, Non-Agricultural Uses in the Agriculture Land Use Category*, Section below.

[2] Ibid.
[3] As concluded in Response 4.2.b, the Project site is not under a Williamson Act contract.

NORTH COAST AREA PLAN

Key provisions found in Area Plans are land use maps, programs, and standards guiding development. The County's Coastal Zone is divided into four planning areas- the Project site is located in the NC Planning Area, within the Rural North Coast (RNC) community. The NC Planning Area is addressed in the North Coast Area Plan (NCAP).

Combining Designations

NCAP Chapter 6 addresses Combining Designations, which are special overlay land use categories applied in areas of the County with potentially hazardous conditions or significant natural resources. In these areas more detailed project review is needed, in order to avoid or minimize adverse environmental impacts, or effects of hazardous conditions on proposed projects. The Combining Designations assigned to the Project site are as follows:

- *Geologic Study Area (GSA)*: The Geologic Study (GSA) designation includes moderate to high landslide risk areas and moderate to high liquefaction hazard areas, as identified in the Seismic Safety Element. Seismic Safety Element Map 4, *Landslide Hazards*, indicates that the Project site contains portions with "High Potential" for landslides. Given this High Potential for landslides, the Project site is designated GSA. Areas of steep slopes require evaluations for engineering problems associated with building. Refer to Section 4.6, *Geology and Soils*.

- *Flood Hazard (FH):* The FH Combining designation is applied to areas where terrain characteristics would present new developments and their users with potential hazards to life and property from potential inundation by a 100-year frequency flood or within coastal high hazard areas. San Simeon Creek is one of seven creeks identified by the NCAP as areas of potential flood hazards where development and fill should be avoided. Maintenance of the creek habitats is essential to protect many coastal resources. These creeks support a number of declining species. Refer to Section 4.9, *Hydrology and Water Quality*.

- *Sensitive Resource Area (SRA):* The SRA Combining Designation is applied to identify areas with special environmental qualities, or areas containing unique or endangered vegetation or habitat resources. According to the NCAP, the entire shoreline is a valuable scenic and natural resource that must be protected from excessive and unsightly development. The entire NC Planning Area also sustains important marine habitats and provides for a variety of passive recreation uses. The SRA Combining Designation applied to the Project site to recognize the onsite scenic resources (creek corridors) and adjacent Monterey pine forest and State Park foot trail (the forest and trail do not extend onto the site's southwestern corner, where the SRA Combining Designation is applied). Refer to Section 4.1, *Aesthetics*, and Section 4.4, *Biological Resources*.

- *Environmentally Sensitive Habitat, Terrestrial Habitat (ESH-TH):* The Monterey Pine Forests SRA-TH Combining Designation involves the Monterey pine forests that cover most of the Cambria Urban Area, and which are present south of the Project site (the forest does not extend onto the site's southwestern corner, where the ESH-TH Combining Designation is applied). Refer to Section 4.4, *Biological Resources*.

- Environmentally Sensitive Habitat, Coastal Creeks (ESH-CC): According to the NCAP, portions of San Simeon Creek (among other creeks) are anadromous fish streams, which should be protected from impediments to steelhead migration and spawning. Adjacent riparian and wetland areas provide important wildlife habitat. Ground and surface waters are linked, and maintenance of the creek habitats is essential to protect many coastal resources. These creeks support a number of declining species. Refer to Section 4.4, *Biological Resources*, and Section 4.9, *Hydrology and Water Quality*.

- *Local Coastal Program (LCP):* The Coastal Zone encompasses all lands within the NC Planning Area. The LCP Combining Designation identifies specific programs to ensure that access to the shoreline is provided and that coastal resources are protected in accordance with the LCP Policies; refer to the *Local Coastal Program Policy Document* Section below.

Planning Area Standards

NCAP Chapter 7 contains Planning Area Standards for the NC Planning Area that are mandatory requirements for development. Planning Area Standards apply to the planning and development of new land uses, and must be satisfied before a new land use permit is approved. The land use-related Areawide, Combining Designation, Land Use Standards relative to the Project are discussed below.

Areawide (AW) Standards

AW standards apply to all RNC lands. The following land-use related AW standards apply to the Project:

Site Design and Building Construction

AW-6 Site Selection. Primary site selection for new development shall be locations not visible from Highway 1 as follows:

a. Sites shall be selected where hills and slopes would shield development unless no alternative location exists or the new development provides visitor-serving facilities.

b. New development shall be located so that no portion of a structure extends above the highest horizon line of ridgelines as seen from Highway 1.

Combining Designation (CD) Standards

CD Standards apply to all RNC lands with LCP and SRA Combining Designations. There are no land use-related CD Standards that apply to the Project.

Land Use (LU) Standards

LU Standards apply to specific land use categories. As previously noted, the Project site is designated Agriculture (AG). There are no land use-related LU Standards that apply to the Project.

Cambria Urban Area Community-Wide Standard 4D

The County issued May 15, 2014 Emergency CDP authorized construction and operation of the emergency water supply project, subject to certain conditions. Specifically, Emergency CDP Condition 6 specifies that the "regular permit will be subject to all applicable provisions of the California Coastal Act and the Local Coastal Program, including the specific requirements for desalination facilities in the North Coast Area Plan Community Wide Policy 4D....." It is assumed Condition 6 is referring to Cambria Urban Area (Community Wide) Standard 4D (NCAP page 7-30). However, CW Standard 4D is found in NCAP Chapter 7 Section B, *Cambria Urban Area Standards*. NCAP Chapter 7 Section B contains "standards that apply only to land within the unincorporated urban area of Cambria" (NCAP page 7-2). However, the Project site is located within the NCAP's rural area, which "includes all those lands outside the Cambria urban reserve line and the San Simeon Acres village reserve line" (NCAP page 4-4). The Planning Area Standards relevant to NCAP's rural area, and thus the Project site, are found in NCAP Chapter 7 Section A, *Rural Area Standards*. NCAP Chapter 7 Section A contains "standards that apply only to land within the unincorporated urban area of Cambria" (NCAP page 7-2). The requirements for compliance with CW Standard 4D

would be verified by the County through the Project's development review process; refer also to the *Coastal Zone Land Use Ordinance* Section below.

LOCAL COASTAL PROGRAM POLICY DOCUMENT

The LCP Policy Document is part of the Local Coastal Program and Land Use Element. The LCP provides a more detailed level of policies, programs, and standards to address Coastal Act issues. The following land use-related LCP policies are relevant to the Project:

Environmentally Sensitive Habitats

Environmentally Sensitive Habitat (ESH) areas are settings in which plant or animal life (or their habitats) are rare or especially valuable due to their special role in an ecosystem. The Coastal Act provides protection for these areas and permits only resource-dependent uses within the habitat area. Development adjacent must be sited to avoid impacts. Refer to the *Combining Designations* Section above for a description of the ESH that are present on the Project site.

LCP 1 *Land Uses Within or Adjacent to Environmentally Sensitive Habitats*. New development within or adjacent to locations of environmentally sensitive habitats (within 100 feet unless sites further removed would significantly disrupt the habitat) shall not significantly disrupt the resource. Within an existing resource, only those uses dependent on such resources shall be allowed within the area.

LCP 2 *Permit Requirement*. As a condition of permit approval, the applicant is required to demonstrate that there will be no significant impact on sensitive habitats and that proposed development or activities will be consistent with the biological continuance of the habitat. This shall include an evaluation of the site prepared by a qualified professional which provides: a) the maximum feasible mitigation measures (where appropriate), and b) a program for monitoring and evaluating the effectiveness of mitigation measures where appropriate.

Wetlands

Wetlands help improve the quality and quantity of water, as well as providing important wildlife habitats. Several rare and/or endangered species are found within local coastal wetlands. There are no wetlands located on or immediately adjacent to the Project site. However, the Project proposes to pump a stream of the AWTP product water southwest of the AWTP for discharge into the San Simeon Creek via LIWs, which are proposed just upstream of the fresh water lagoon, approximately 2,500 feet southwest of existing Well 9P7. As an option to the LIWs, the existing Well 9P7 discharge pipeline and discharge structure may be used to discharge directly into Van Gordon Creek adjacent to the AWTP. Refer to Section 4.4, *Biological Resources*.

LCP 16 *Adjacent Development*. Development adjacent to coastal wetlands shall be sited and designed to prevent significant impacts to wetlands through noise, sediment or other disturbances. Development shall be located as far away from the wetland as feasible, consistent with other habitat values on the site.

Coastal Streams

Coastal streams directly affect the coastal environment. They significantly influence flooding, natural ecosystems, sediment transport, agricultural water supply and groundwater recharge within the coastal zone. The San Simeon Creek and Van Gordon Creek traverse the southeastern and western portions of the Project site.

LCP 21 *Development in or Adjacent to a Coastal Stream*. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 28 *Buffer Zone for Riparian Habitats*. In rural areas (outside the USL) a buffer setback zone of 100 feet shall be established between any new development (including new agricultural development) and the upland edge of riparian habitats. In urban areas this minimum standard shall be 50 feet except where a lesser buffer is specifically permitted. The buffer zone shall be maintained in natural condition along the periphery of all streams. Permitted uses within the buffer strip shall be limited to passive recreational, educational, or existing nonstructural agricultural developments in accordance with adopted best management practices. Other uses that may be found appropriate are limited to utility lines, pipelines, drainage and flood control facilities, bridges and road approaches to bridges to cross a stream and roads when it can be demonstrated that: 1) alternative routes are infeasible or more environmentally damaging and 2) adverse environmental effects are mitigated to the maximum extent feasible. Lesser setbacks on existing parcels may be permitted if application of the minimum setback standard would render the parcel physically unusable for the principal permitted use. In allowing a reduction in the minimum setbacks, they shall be reduced only to the point at which a principal permitted use (as modified as much as is practical from a design standpoint) can be accommodated.

Terrestrial Environments

Terrestrial environments within the County's coastal zone include unique plant habitats and rare and endangered animal habitats. Refer to the *Combining Designations* Section above for a description of the TH that are present on or adjacent to the Project site.

LCP 29 *Protection of Terrestrial Habitats*. Designated plant and wildlife habitats are environmentally sensitive habitat areas and emphasis for protection should be placed on the entire ecological community. Only uses dependent on the resource shall be permitted within the identified sensitive habitat portion of the site.

Development adjacent to environmentally sensitive habitat areas and holdings of the State Department of Parks and Recreation shall be sited and designed to prevent impacts that would significantly degrade such areas and shall be compatible with the continuance of such habitat areas.

Visual and Scenic Resources

The identification and protection of visual resources within the coastal zone is a critical aspect of planning for long-term change and development within highly scenic coastal regions. The Project site's features that are considered visual resources involve the San Simeon Creek and Van Gordon Creek corridors that traverse the southeastern and western portions of the Project site, respectively. Additional visual resources in the Project's vicinity involve the Monterey pine forest and State Park foot trail situated south of the Project site, between the San Simeon Creek corridor and State Park Washburn Primitive Campground. A minimal portion of the Project site's southwestern corner is designated SRA and ESH-TH to recognize these visual resources, although, the forest and trail do not extend onto the site's southwestern corner.

LCP 2 *Site Selection for New Development*. Permitted development shall be sited so as to protect views to and along the ocean and scenic coastal areas. Wherever possible, site selection for new development is to emphasize locations not visible from major public view corridors. In particular, new development should utilize slope created "pockets" to shield development and minimize visual intrusion.

LCP 4 *New Development in Rural Areas*. New development shall be sited to minimize its visibility from public view corridors. Structures shall be designed (height, bulk, style) to be subordinate to, and blend with, the rural character of the area. New development which cannot be sited outside of public view corridors is to be screened utilizing native vegetation; however, such vegetation, when mature, must also be selected and sited in such a manner as to not obstruct major public views. New land divisions whose only building site would be on a highly visible slope or ridgetop shall be prohibited.

LCP 7 *Preservation of Trees and Native Vegetation*. The location and design of new development shall minimize the need for tree removal.

The Project would be subject to compliance with these aforementioned land use-related LCP Policies, as well as the LCP Policies identified throughout Section 4 of this Initial Study. Compliance with these LCP Policies would be achieved through compliance with the CZLUO; see below.

COASTAL ZONE LAND USE ORDINANCE (CZLUO)

As previously noted, the Project site is located in the County's Coastal Zone. Therefore, the provisions of Title 23 of the San Luis Obispo County Code, *Coastal Zone Land Use Ordinance*, apply to all land use and development activities associated with the Project.

CZLUO Section 23.01.031 (Land Use and Coastal Development Permits Required). Pursuant to this Section, no person shall establish, construct, alter, or replace any use of land, structure, or building without first obtaining all permits required by CZLUO Chapter 23.03 or other applicable section of Title 23, except as otherwise provided by Section 23.01.031. Approval of a land use permit pursuant to Title 23 also constitutes approval of a Coastal Development Permit in compliance with the County's LCP and California Coastal Act. As discussed in Section 2.2, *Background and History*, the County issued an Emergency CDP on May 15, 2014, authorizing construction and operation of the proposed emergency Project, subject to certain conditions. Specifically, Emergency CDP Condition 6 specifies the following:

> *Within 30 days of the date of issuance of this emergency permit, the permittee shall apply for a regular Coastal Development Permit to authorize the emergency project…..*

In compliance with Emergency CDP Condition 6, an application for a regular CDP was submitted to the County on June 13, 2014. This Initial Study was provided as supporting documentation to the CDP application.

CZLUO Section 23.01.033 (Consistency With the Land Use Element and Local Coastal Plan Required). This Section specifies that no new use of land, buildings, division of land, or other development shall be established, and no application for such use, land division, or other permit required pursuant to Title 23 shall be approved, unless the proposed use is determined to be allowable in the land use category where the proposed site is located. When an application is accepted for processing, such application shall not be approved unless:

a. The proposed use is identified as an "A", "S" or "P" use by Table O, Part I of the Land Use Element in the land use category where the site for the proposed use is located;

b. The proposed use or division satisfies the standards of the Land Use Element (Part II) applicable to the specific planning area in which the site is located, including any standards may limit the type of land uses or parcel sizes normally allowable in a given land use category;

c. The proposed use or division satisfies any combining designation planning area standards applied to the site by the Land Use Element (Part II), including any such standards that may limit the type of land uses or parcel sizes normally allowable in a given land use category;

d. The proposed use or division satisfies any policies, programs, and standards contained in the Local Coastal Plan Policy Document; and

e. The proposed use or division satisfies the terms, conditions and other requirements of all implementing regulations adopted as part of the Local Coastal Program including but not limited to any categorical exclusion.

CZLUO Section 23.01.034 (Compliance With Standards Required). This Section specifies that no use of land, buildings, or division of land shall be established and no application for a use of land, buildings, or land division pursuant to County Code Title 21 shall be approved unless the proposed land use, building, or parcels satisfy all applicable requirements of this Code.

CZLUO Chapter 23.04 (Site Design Standards). This Chapter establishes standards for the design and layout of sites for land uses, new developments, and divisions of land, where allowed by the Land Use Element. The purpose of these standards is to support, through site evaluation and design, the establishment of land uses in a manner that is compatible with existing land uses and neighborhoods; the natural environment; and the health and safety of County residents. Standards are provided for various site development features (parcel size; minimum site area; setbacks; heights; fencing and screening; and outdoor lights, among others).

CZLUO Section 23.04.050 (Non-Agricultural Uses in the Agriculture Land Use Category). The Project site is designated AG Land Use Category. This section establishes permit requirements and standards for non-agricultural uses in the AG category.

b. Supplemental Non-Agricultural Uses.

(1) Supplemental non-agricultural uses defined: Uses allowed by Coastal Table "O" in the Agriculture category that are not directly related to the principal agricultural use on the site.

(3) Permit requirement: Minor use permit approval, unless Development Plan approval is otherwise required by another provision of this title or planning area standard of the Land Use Element.

(4) Required findings: Supplemental non-agricultural uses may be established only if the following findings are made by the applicable approval body:

(i) For prime soils, it has been demonstrated that no alternative project site exists except on prime soils; and
(ii) The least amount of prime soils possible will be converted; and
(iii) The proposed use will not conflict with surrounding agricultural lands and uses.

The Project would be subject to compliance with the relevant site design standards specified in CZLUO Chapter 23.04.

CZLUO Chapter 23.05 (Site Development Standards). This Chapter establishes standards for the preparation of sites for development and construction activities, in order to protect against unwarranted or unsafe grading, or soil erosion resulting from grading; by defining appropriate circumstances for tree removal; by providing for adequate drainage and fire protection facilities; and by identifying appropriate standards for other aspects of site development. The Project would be subject to compliance with the relevant site development standards specified in CZLUO Chapter 23.05.

CZLUO Chapter 23.06 (Operational Standards). This Chapter establishes standards to be applied to the operation and conduct of land uses after their establishment, and on a continuing basis. These standards are established to protect from the adverse effects of excessive or objectionable emissions of noise or air contaminants that may be generated by land uses, activities, processes, or equipment. The Project would be subject to compliance with the relevant operational standards specified in CZLUO Chapter 23.06.

CZLUO Chapter 23.07 (Combining Designation Standards). The purpose of Combining Designation standards is to require project design that will give careful consideration to the land features, structures, and activities identified by the Combining Designations. The Project would be subject to compliance with the relevant Combining Designation standards specified in CZLUO Chapter 23.07. The Project site is designated with various Combining Designations, as outlined in the Official Maps Section above. Accordingly, the Project would be subject to compliance with the following CZLUO sections:

- San Simeon Creek Flood Hazard (FH): Sections 23.07.060 through 23.07.066;
- Geologic Study Area (GSA): Sections 23.07.080 through 23.07.086;
- Sensitive Resource Area (SRA): Sections 23.07.160 through 23.07.166;
- Environmentally Sensitive Habitat, Terrestrial Habitat (ESH-TH): Section 23.07.176;
- Environmentally Sensitive Habitat, Coastal Creek (ESH-CC): Sections 23.07.170 and 23.07.174;
- Local Coastal Program (LCP): Section 23.07.120.

CZLUO Chapter 23.08 (Special (S) Uses). The purpose of this Chapter is to establish special additional standards for certain land uses that may affect adjacent properties, the neighborhood, or the community even if the uniform standards of Chapter 23.04 and all other standards of Title 23 are met. Such uses are defined as "S" and "S-P" uses by Coastal Table O, Chapter 7, Part I of the Land Use Element. This Chapter establishes appropriate standards for permit processing, and the location, design, and operation of special uses, to avoid unanticipated problems or hazards, and to assure they will be consistent with the County General Plan. As noted above, the Project site is consistent with the "Public Utility Facilities [J5]" land use definition. Per Table O of the *Coastal Zone Framework for Planning*, Public Utility Facilities on sites designated RSF category are "S-13" status. The S-13 status indicates the land use is a special use, allowable subject to special standards and/or processing requirements, unless otherwise limited by a specific planning area standard.

CZLUO Section 23.08.280 (Transportation, Utilities, and Communication (S-13)). Transportation and Public Utility Facilities identified as allowable, S-13 uses by the Land Use Element (see Coastal Table 0, Part I of the Land Use Element) are subject to CZLUO Section 23.08.288, *Public Utility Facilities*.

CZLUO Section 23.08.288 (Public Utility Facilities): The requirements of this section apply to Public Utility Facilities where designated as S-13 uses by Coastal Table "O." Public Utility Facilities (other than electric and communications transmission and natural gas regulation and distribution) require Development Plan approval pursuant to Section 23.02.034, *Development Plan*.

(a) Permit Requirements. In addition to the emergency repair and the general permit requirements of Section 23.08.286 (a) and (b), development plan approval is required for any new facility or modification of any existing facility in the agriculture, rural lands, residential, office and professional, and commercial land use categories. Development plan approval is required for any new facility or modification to any existing facility which would increase the structure heights above those specified in Section 23.04.124 or modify any operational standards causing an increase in any of the categories specified in Chapter 23.06 of this title.

(b) Application Contents. In addition to the application materials required by Chapter 23.02, permit applications shall also include descriptions of:

(1) The proposed design capacity of the facility; the operating schedule; and how the proposed facility interacts with incoming and outgoing utility services.
(2) Plans for any overhead or underground transmission lines, transformers, inverters, switchyards or any required new or upgraded off-site transmission facilities.
(3) Proposed erosion control measures, revegetation, screening and landscaping during construction and operation.
(4) An oil and hazardous material spill contingency plan, including a demonstration that all materials can be contained on-site.
(5) For electric and telephone centers, estimates of the non-ionizing radiation generated and/or received by the facility. These will include estimates of the maximum electric and magnetic field strengths at the edge of the facility site, the extent that measurable fields extend in all directions from the facility.
(6) The number and identification by trades of estimated construction and operation forces. If construction is estimated to take over six months, the construction workforce shall be estimated for each six-month period. The estimates shall include numbers of locally hired employees and employees who will move into the area, and a discussion of the estimated impact that employees moving into the area will have on housing, schools and traffic.

(c) Development Standards. The following standards apply in addition to any that may be established as conditions of approval:

(1) Environmental Quality Assurance. An environmental quality assurance program covering all aspects of construction and operation shall be submitted prior to construction of any project component. This program will include a schedule and plan for monitoring and demonstrating compliance with all conditions required by the development plan. Specific requirements of this environmental quality assurance program will be determined during the environmental review process and development plan review and approval process.
(2) Clearing and Revegetation. The land area exposed and the vegetation removed during construction shall be the minimum necessary to install and operate the facility. Topsoil will be stripped and stored separately. Disturbed areas no longer required for operation will be regraded, covered with topsoil and replanted during the next appropriate season.
(3) Fencing and Screening. Public utility facilities shall be screened on all sides. An effective visual barrier will be established through the use of a solid wall, fencing and/or landscaping. The adequacy of the proposed screening will be determined during the land use permitting process.

(d) Limitation on Use, Sensitive Environmental Areas. Uses shall not be allowed in sensitive areas such as on prime agricultural soils, sensitive resource areas, environmentally sensitive habitats, or hazard areas, unless a finding is made by the applicable approval body that there is no other feasible location on or off-site the property. Applications for public utility facilities in the above sensitive areas shall include a feasibility study, prepared by a qualified professional approved by the environmental coordinator. The feasibility study shall include a constraints analysis, and analyze alternative locations.

The Project would be subject to compliance with the land use-related CZLUO standards specified above, as well as the standards identified throughout Section 4 of this Initial Study.

Overall, as concluded above, the Project proposed at the existing San Simeon well field and percolation pond system site (designated AG Category) is an allowable special use, subject to special standards and/or processing requirements, as outlined above. Coastal Development Plan (CDP) approval is required. The County issued an Emergency CDP on May 15, 2014, authorizing construction and operation of the proposed emergency Project, subject to certain conditions. General Emergency CDP Condition 6 specifies that the permittee (CCSD) is required to apply for a regular CDP Permit within 30 days of the date of issuance of the Emergency CDP. In compliance with

Emergency CDP Condition 6, an application for a regular CDP was submitted to the County on June 13, 2014. This Initial Study was provided as supporting documentation to the CDP application.

The Project would be evaluated through the County's discretionary review process, in order to confirm it satisfies the relevant NCAP Planning Area standards, LCP Policies, and CZLUO standards, as outlined above and throughout this Initial Study. Issuance of the regular CDP constitutes compliance with the requirements of the Coastal Zone Land Use Element (i.e., Framework for Planning, NCAP, and LCP Policies Document), CZLUO, and any other relevant County and State regulatory policies and regulations. CDP approval also constitutes approval of a Development Plan in compliance with the County's LCP and California Coastal Act. Therefore, the Project would be in compliance with the land use plan, policies, and regulations adopted for the purpose of avoiding or mitigating an environmental effect, upon issuance of the regular CDP. A less than significant impact would occur in this regard.

EXISTING REGULATIONS

Refer to the North Coast Area Plan, Local Coastal Program Policies, Coastal Zone Land Use Ordinance Standards identified above.

MITIGATION MEASURES

No mitigation is required.

4.10.c Conflict with any applicable habitat conservation plan or natural community conservation plan?

No Impact. As stated in Response 4.4.f, the Project site is not located within an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved habitat conservation plan.

MITIGATION MEASURES

No mitigation is required.

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4.11 MINERAL RESOURCES

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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?				✓

IMPACT ANALYSIS

4.11.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?

No Impact. The County's EX (Energy or Extractive Resource Area) and EX1 (Extractive Resource Area) Combining Designations include areas that have been identified as containing or likely to contain significant mineral resources; see Conservation Element Figure MN-2, *Energy and Extractive Resource Area Locations (EX and EX1)*. As shown, the Project site does not contain known mineral resources. Therefore; the Project would not result in the loss of availability of a known mineral resource.

MITIGATION MEASURES

No mitigation is required.

4.11.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?

No Impact. Conservation Element Figure MN-1, *Mining (SMARA) Locations*, shows the locations of the County's existing mines and indicates none are located on the Project site. Therefore, Project implementation would not result in the loss of a locally important mineral resource recovery site.

MITIGATION MEASURES

No mitigation is required.

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4.12 NOISE

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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 groundborne vibration or groundborne 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?				✓

INTRODUCTION

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air, and is characterized by both its amplitude and frequency (or pitch). The human ear does not hear all frequencies equally. In particular, the ear de-emphasizes low and very high frequencies. To better approximate the sensitivity of human hearing, the A-weighted decibel scale (dBA) has been developed. On this scale, the human range of hearing extends from approximately three dBA to around 140 dBA.

Noise is generally defined as unwanted or excessive sound, which can vary in intensity by over one million times within the range of human hearing; therefore, a logarithmic scale, known as the decibel scale (dB), is used to quantify sound intensity. Noise can be generated by a number of sources, including mobile sources such as automobiles, trucks, and airplanes, and stationary sources such as construction sites, machinery, and industrial operations. Noise generated by mobile sources typically attenuates (is reduced) at a rate between three dBA and 4.5 dBA per doubling of distance. The rate depends on the ground surface and the number or type of objects between the noise source and the receiver. Hard and flat surfaces, such as concrete or asphalt, have an attenuation rate of three dBA per doubling of distance. Soft surfaces, such as uneven or vegetated terrain, have an attenuation rate of about 4.5 dBA per doubling of distance. Noise generated by stationary sources typically attenuates at a rate between 6 dBA and about 7.5 dBA per doubling of distance.

There are a number of metrics used to characterize community noise exposure, which fluctuate constantly over time. One such metric, the equivalent sound level (Leq), represents a constant sound that, over the specified period, has the same sound energy as the time-varying sound. Noise exposure over a longer period of time is often evaluated based on the Day-Night Sound Level (Ldn). This is a measure of 24-hour noise levels that incorporates a 10-dBA penalty for sounds occurring between 10:00 p.m. and 7:00 a.m. The penalty is intended to reflect the increased human sensitivity to noises occurring during nighttime hours, particularly at times when people are sleeping and there

are lower ambient noise conditions. Typical Ldn noise levels for light and medium density residential areas range from 55 dBA to 65 dBA.

NOISE SENSITIVE RECEPTORS

On May 15, 2014, the County issued an Emergency CDP authorizing construction and operation of the proposed emergency Project, subject to various conditions. CDP General Condition 6F specifies the following regarding the effects of Project-related noise on nearby biological resources and public recreation:

> *The permittee shall identify expected noise and light levels from project construction and operation at nearby sensitive receptors, including riparian areas, known and potential bird nesting sites, and the nearest public recreation sites, including the State Park campground. The permittee shall identify all measures proposed to be implemented to reduce noise and light effects on those nearby receptors.*

Accordingly, the following discussion of noise sensitive receptors considers riparian areas and the State Park campground, including the residential dwellings therein (campground host housing).

The noise sensitive receptors located on or near the Project site include the following (note these distances are from the Project boundary and not the actual areas of disturbance/construction activities):

- The onsite environmentally sensitive habitats (the San Simeon Creek and Van Gordon Creek corridors that traverse the southeastern and western portions of the Project site, respectively);
- The nearby public recreation sites (the State Park Washburn Primitive Campground located approximately 2,625 feet to the southeast and San Simeon Creek Campground located approximately 75 feet to the west, just south of San Simeon – Monterey Creek Road); and
- Two single-family dwellings (State Park personnel and/or camp hosts) located approximately 450 feet to the west (of the proposed AWTP), approximately 750 feet south of San Simeon - Monterey Creek Road.

IMPACT ANALYSIS

4.12.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?

Less Than Significant With Mitigation Incorporated.

Short-Term Noise Impacts

The proposed water facilities are described in Section 2.0, *Project Description*. Project construction would include grading, trenching, excavation, construction, as well as installation of equipment on structural footings and concrete pads. It is anticipated that only a minimal amount of earthmoving activities would occur due to the proposed water supply facilities. Construction would occur over a four month period.

Ground-borne noise and other types of construction-related noise impacts would typically occur during the initial construction phases. These phases of construction have the potential to create the highest levels of noise. Typical noise levels generated by construction equipment are shown in Table 4.12-1, *Maximum Noise Levels Generated by Construction Equipment*. Operating cycles for these types of construction equipment may involve one or two minutes of full power operation followed by three to four minutes at lower power settings. Other primary sources of acoustical disturbance would be due to random incidents, which would last less than one minute (such as dropping large pieces of equipment or the hydraulic movement of machinery lifts).

Table 4.12-1
Maximum Noise Levels Generated by Construction Equipment

Type of Equipment	Acoustical Use Factor[1]	Maximum Noise Level at 50 Feet (A-weighted decibels)
Concrete Saw	20	90
Crane	16	81
Concrete Mixer Truck	40	79
Backhoe	40	78
Dozer	40	82
Excavator	40	81
Forklift	40	78
Paver	50	77
Roller	20	80
Tractor	40	84
Water Truck	40	80
Grader	40	85
General Industrial Equipment	50	85

Note:
1 – Acoustical Use Factor (percent): Estimates the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation.

Source: Federal Highway Administration, *Roadway Construction Noise Model (Federal Highway Administration-HEP-05-054)*, January 2006.

Construction activities would also cause increased noise along access routes to and from the site due to movement of equipment and workers. As the Project involves construction of emergency water facilities, substantial soil hauling is not anticipated to occur along local roadways due to the minimal amount of earthmoving and grading activities.

The Project is subject to compliance with Coastal Zone Land Use Ordinance (CZLUO) Sections 23.06.042 through 23.06.050, which establish standards for acceptable exterior and interior noise levels. Construction noise would be acoustically dispersed throughout the Project site and not concentrated in one area near adjacent sensitive uses. Nearby noise sensitive receptors could be exposed to short-term construction-related noise levels in excess of the standards specified in the CZLUO. However, according to CZLUO Section 23.06.042 (Exceptions to Noise Standards), the standards of CZLUO Sections 23.06.044 through 23.06.050 are not applicable to noise from various exempt sources, including: the use of any mechanical device, apparatus or equipment related to or connected with emergency activities or emergency work to protect life or property; and noise sources associated with construction, provided such activities do not take place before 7:00 a.m. or after 9:00 p.m. any day except Saturday or Sunday, or before 8:00 a.m. or after 5:00 p.m. on Saturday or Sunday. These permitted hours of construction are included in CZLUO Section 23.06.042 in recognition that construction activities undertaken during daytime hours are a typical part of living in an urban environment and do not cause a significant disruption. Given the sporadic nature of noise levels generated during Project construction and implementation of time limits specified in the CZLUO, construction noise impacts would be less than significant. Further, as noted in Section 4.4, *Biological Resources*, should the pre-construction clearance survey determine that an active avian nest is present in the sensitive habitat areas; a no-work buffer may be established. The size of the buffer shall be determined by the biologist in consultation with the California Department of Fish and Wildlife and would be based on the nesting species, its sensitivity to disturbance, and expected types of disturbance. Typically these buffers range from 250 to 500 feet from the nest location. To further reduce the potential for noise impacts, Mitigation Measure NOI-1 would be implemented to incorporate best management practices during construction. Implementation of Mitigation Measure NOI-1 would further minimize

impacts from construction noise, as it requires construction equipment to be equipped with properly operating and maintained mufflers and other state required noise attenuation devices. Thus, with mitigation, a less than significant noise impact would result from construction activities.

Operational Noise Impacts

Implementation of the proposed water facilities could increase noise levels in noise-sensitive areas. Noise-producing equipment typically associated with these types of facilities includes electrical pump motors, pump filtration systems, and transformers. The wellhead facilities would not include pumps or noise generating equipment and therefore noise associated with the wells would have no impact. Key AWTP processes would be pre-packaged and mounted in shipping containers. As the equipment would be fully enclosed in AWTP containers, it would attenuate operational noise levels pursuant to CZLUO noise standards.

The spray evaporators proposed along the west berm would include soundwall enclosures, which would be either a Sound Fighter System or a treated wood product; see Exhibit 2-10, *Spray Evaporators*. With these soundwall enclosures, the noise produced by the spray evaporators would be 42 dBA at 200 feet (property line of the campground to the west) and 40 dBA at 250 feet (closest occupied area within campground to the west) and would fall below the CZLUO's noise level limits. Further, as the spray evaporators would be located approximately 400 feet from the habitat areas within the creek corridor, noise levels produced by the spray evaporators would not be perceptible above the ambient noise levels in the area. Therefore, stationary noise impacts from the proposed facilities would be less than significant.

EXISTING REGULATIONS

Coastal Zone Land Use Ordinance Standards:

CZLUO Chapter 23.06 (Operational Standards). This Chapter establishes standards to be applied to the operation and conduct of land uses after their establishment, and on a continuing basis. These standards are established to protect residents from the adverse effects of excessive or objectionable emissions of noise that may be generated by land uses, activities, processes or equipment. The purpose of this chapter is also to identify acceptable levels of noise and other emissions in various land use categories, and to set forth procedures for coordinating the review of development projects with the APCD.

CZLUO Section 23.06.040 (Noise Standards). CZLUO Sections 23.06.044 through 23.06.050 establish standards for acceptable exterior and interior noise levels and describe how noise is to be measured. These standards are intended to protect persons from excessive noise levels, which are detrimental to the public health, welfare, and safety and contrary to the public interest. It is the intent of this chapter to protect persons from excessive levels of noise within or near various residential development and other specified noise-sensitive land uses.

CZLUO Section 23.06.042 (Exceptions to Noise Standards). The standards of CZLUO Sections 23.06.044 through 23.06.050 are not applicable to noise from the following sources:

(2) The use of any mechanical device, apparatus or equipment related to or connected with emergency activities or emergency work to protect life or property;

(4) Noise sources associated with construction, provided such activities do not take place before 7:00 a.m. or after 9:00 p.m. any day except Saturday or Sunday, or before 8:00 a.m. or after 5:00 p.m. on Saturday or Sunday; and

(8) Noise sources associated with work performed by private or public utilities in the maintenance or modification of its facilities.

CZLUO Section 23.06.044 (Exterior Noise Level Standards). The exterior noise level standards of this section are applicable when a land use affected by noise is one of the following noise-sensitive uses which are defined in the land use element and local coastal plan: residential uses listed in Table O, framework for planning, except for residential accessory uses and temporary dwellings; health care services (hospitals and similar establishments only); hotels and motels; bed and breakfast facilities; schools (preschool to secondary, college and university, specialized education and training); churches; libraries and museums; public assembly and entertainment; offices, and outdoor sports and recreation.

(1) No person shall create any noise or allow the creation of any noise at any location within the unincorporated areas of the county on property owned, leased, occupied or otherwise controlled by such person which causes the exterior noise level when measured at any of the preceding noise-sensitive land uses situated in either the incorporated or unincorporated areas to exceed the noise level standards in the following table. When the receiving noise-sensitive land use is outdoor sports and recreation, the following noise level standards shall be increased by ten dB.

Table 4.12-2
Exterior Noise Level Standards

Noise Standard	Daytime (7 a.m. to 10 p.m.)	Nighttime[1] (10 p.m. to 7 a.m.)
Hourly equivalent sound level (Leq, dB) 50 45	50	45
Maximum level, dB 70 65	70	65

Notes:
1. Applies only to uses that operate or are occupied during nighttime hours.

(2) In the event the measured ambient noise level exceeds the applicable exterior noise level standard in subsection (1), the applicable standard shall be adjusted so as to equal the ambient noise level plus one dB.
(3) Each of the exterior noise level standards specified in subsection (1) shall be reduced by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.

(4) If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the exterior noise level standards.

MITIGATION MEASURES

NOI-1 Prior to Grading Permit issuance, the Project applicant shall demonstrate, to the satisfaction of the County of San Luis Obispo Planning and Building Manager that the Project complies with the following:

- Construction contracts specify that all construction equipment, fixed or mobile, shall be equipped with properly operating and maintained mufflers and other state required noise attenuation devices.

- During construction, stationary construction equipment shall be placed such that emitted noise is directed away from sensitive noise receivers.

- Construction equipment staging areas shall be located away from adjacent sensitive receptors.

- Construction activities shall not take place outside of the allowable hours specified by the County's Municipal Code Section 23.06.042, (7:00 a.m. to 9:00 p.m. any day except Saturday or Sunday, or 8:00 a.m. to 5:00 p.m. on Saturday or Sunday).

4.12.b Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Less Than Significant Impact.

Short-Term Construction

Project construction can generate varying degrees of groundborne vibration, depending on the construction procedure and the construction equipment used. Operation of construction equipment generates vibrations that spread through the ground and diminish in amplitude with distance from the source. The effect on buildings located in the vicinity of the construction site often varies depending on soil type, ground strata, and construction characteristics of the receiver building(s). The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibration at moderate levels, to slight damage at the highest levels. Groundborne vibrations from construction activities rarely reach levels that damage structures.

The types of construction vibration impact include human annoyance and building damage. Human annoyance occurs when construction vibration rises significantly above the threshold of human perception for extended periods of time. Building damage can be cosmetic or structural. Ordinary buildings that are not particularly fragile would not experience any cosmetic damage (e.g., plaster cracks) at distances beyond 30 feet. This distance can vary substantially depending on the soil composition and underground geological layer between vibration source and receiver. In addition, not all buildings respond similarly to vibration generated by construction equipment. For example, for a building that is constructed with reinforced concrete with no plaster, the Federal Transit Administration (FTA) guidelines show that a vibration level of up to 0.50 inch per second (in/sec) (102 velocity decibels [VdB]) is considered safe and would not result in any construction vibration damage. The vibration produced by construction equipment is presented in Table 4.12-3, *Typical Vibration Levels for Construction Equipment*.

Table 4.12-3
Typical Vibration Levels for Construction Equipment

Equipment	Approximate peak particle velocity at 75 feet (inches/second)
Large bulldozer	0.0017
Loaded trucks	0.0015
Small bulldozer	0.0001
Jackhammer	0.0015
Caisson drilling	0.0017

Notes:
1. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Guidelines*, May 2006. Table 12-2.
2. Calculated using the following formula:
   $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
   where: PPV (equip) = the peak particle velocity in in/sec of the equipment adjusted for the distance
   PPV (ref) = the reference vibration level in in/sec from Table 12-2 of the FTA *Transit Noise and Vibration Impact Assessment Guidelines*

D = the distance from the equipment to the receiver

The Project site is not located within one-half mile of an urban or village reserve line, thus, is exempt from CZLUO Section 23.06.060 (*Vibration Standards*). Moreover, *CZLUO Section 23.06.062 (Exceptions to Standards)* specifies that vibration standards of this Chapter are not applicable to: vibrations from construction, the demolition of structures, surface mining activities or geological exploration between 7:00 a.m. and 9:00 p.m.; or vibrations from moving sources such as trucks and railroads.

Groundborne vibration decreases rapidly with distance. The nearest sensitive receptors are public recreation uses (the campground) located approximately 75 feet to the west, just south of San Simeon – Monterey Creek Road). The nearest construction activities that would take place would be associated with construction vehicles traveling along Van Gordon Creek Road. As indicated in Table 4.12-3, based on the Federal Transit Administration (FTA) data, vibration velocities associated with a loaded truck are 0.0015 inch-per-second peak particle velocity (PPV) at 75 feet from the source of activity. With regard to the Project, groundborne vibration would be generated primarily during site clearing and grading activities on-site and by off-site haul-truck travel. Therefore, as the vibration levels would be below the 0.20 inch-per-second PPV significance threshold, a less than significant impact would occur in this regard.

Long-Term Operations

The Project proposes emergency water supply facilities, which would not generate ground-borne vibration that could be felt at surrounding sensitive receptors. No impact would occur in this regard.

EXISTING REGULATIONS

Coastal Zone Land Use Ordinance Standards:

CZLUO Section 23.06.060 (Vibration Standards). Any land use conducted in or within one-half mile of an urban or village reserve line is to be operated to not produce detrimental earth-borne vibrations perceptible at the points of determination identified in the following table:

Table 4.12-4
CZLUO Vibration Standards

Land Use Category in Which Vibration Source is Located	Point of Determination
Residential, office and professional, recreation, commercial	At or beyond any lot line of the lot containing the use
Industrial	At or beyond the boundary of the industrial category

CZLUO Section 23.06.062 (Exceptions to Standards). The vibration standards of this chapter are not applicable to:

(1) Vibrations from construction, the demolition of structures, surface mining activities or geological exploration between 7:00 a.m. and 9:00 p.m.;

(2) Vibrations from moving sources such as trucks and railroads.

MITIGATION MEASURES

No mitigation measure is required.

4.12.c A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

Less Than Significant With Mitigation Incorporated. The Project involves the construction and operation of emergency water supply facilities. Project construction would only generate noise during allowable construction hours, as specified in the CZLUO; refer to Response 4.12.a. Mitigation Measure NOI-1 has also been included to ensure that noise impacts from construction would be below the CZLUO's threshold of significance.

Facility operations associated with the Project have the potential to increase ambient noise levels on-site. However, the spray evaporators, AWTP, and associated equipment would be enclosed or shielded within noise-attenuating enclosures. Therefore, impacts in this regard are anticipated to be less than significant.

MITIGATION MEASURES

Refer to Mitigation Measure NOI-1. No additional mitigation is required.

4.12.d Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above the levels existing without the project?

Less Than Significant With Mitigation Incorporated. Refer to Responses 4.12.a and 4.12.b.

MITIGATION MEASURES

Refer to Mitigation Measure NOI-1. No additional mitigation is required.

4.12.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?

No Impact. The Project site is located approximately 37 miles northwest of the San Luis Obispo County Regional Airport and is not located within the *Airport Land Use Plan for the San Luis Obispo County Regional Airport*. Therefore, the Project would not expose people residing or working in the Project area to excessive noise levels associated with aircraft.

MITIGATION MEASURES

No mitigation measure is required.

4.12.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?

No Impact. The Rancho San Simeon Airport is located approximately one mile northwest of the Project site. However, the Project would not expose people residing or working in the Project area to excessive noise levels associated with aircraft. Therefore, no impacts would occur in this regard.

MITIGATION MEASURES

No mitigation measure is required.

4.13 POPULATION AND HOUSING

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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?				✓

IMPACT ANALYSIS

4.13.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)?

No Impact. The CCSD is a limited purpose special district that provides water and wastewater services. It has no authority over land use or development permitting. The entity that has authority over land use and development permitting in Cambria is the County of San Luis Obispo, which has adopted a Growth Management Ordinance (GMO). Under the GMO the "allocation" of new units (i.e. "growth") in Cambria is currently set by ordinance at zero (0 percent). Any changes to the allocation limit percentage for Cambria based upon the existence of the Project would require adoption of an amendment to the GMO by the County Board of Supervisors, however, no such changes have been proposed in relation to the Project. Rather, the CCSD is pursuing the Project out of significant concerns that it will not have sufficient water to meet the needs of its current customers. If and when any changes to the allocation limit percentage for Cambria in the GMO are ever proposed and considered by the County, any growth inducing impacts would necessarily have to be addressed in an appropriate environmental document at that time. At this time, however, since the CCSD does not have any authority over growth and land use and is pursuing the Project to meet the needs of the existing community, there are no growth inducing impacts from the Project.

MITIGATION MEASURES

No mitigation is required.

4.13.b Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?

4.13.c Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

No Impact. There is no housing or other development on the Project site. Therefore, the Project would not displace existing housing or persons, or necessitate the construction of replacement housing elsewhere.

MITIGATION MEASURES

No mitigation is required.

4.14 PUBLIC SERVICES

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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:				
1) Fire protection?			✓	
2) Police protection?			✓	
3) Schools?				✓
4) Parks?				✓
5) Other public facilities?				✓

IMPACT ANALYSIS

4.14.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:

4.14.a.1 Fire protection?

4.14.a.2 Police protection?

Less Than Significant Impact. Due to the nature and scope of the proposed water facilities, Project implementation would result in a nominal increase in the demand for fire and police protection services. The Project would not affect existing service ratios or response times, and new governmental facilities would not be required. The proposed facilities would not increase the demand for fire or police protection.

MITIGATION MEASURES

No mitigation is required.

4.14.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:

4.14.a.3 Schools?

4.14.a.4 Parks?

4.14.a.5 Other public facilities?

No Impact. The Project involves construction of water facilities to address an existing water supply shortage. The Project does not involve the construction of school, park, or other government facilities. Housing and employment-generating land uses are not proposed, thus, the Project does not create a demand for new schools, parks, or other government facilities.

MITIGATION MEASURES

No mitigation is required.

4.15 RECREATION

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a. Would the project 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. Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?				✓

IMPACT ANALYSIS

4.15.a Would the project 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?

4.15.b Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

No Impact. The Project involves construction of water facilities to address an existing water supply shortage. Housing and employment-generating land uses are not proposed, thus, the Project would not increase the use of existing recreational facilities. The Project does not include recreational facilities.

MITIGATION MEASURES

No mitigation is required.

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4.16 TRANSPORTATION/TRAFFIC

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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?				✓

IMPACT ANALYSIS

4.16.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?

4.16.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?

Less Than Significant Impact. The Project involves construction and operation of emergency water facilities at CCSD's existing San Simeon well field and percolation pond system property. Construction access to the Project site would be provided along the northern site boundary via San Simeon - Monterey Creek Road, and along the western site boundary Van Gordon Creek Road. The "window" of construction-related activities at the Project site would be approximately 180 days.

During Project construction, movement of equipment and workers to and from the site would temporarily increase traffic volumes along access routes. The primary heavy construction equipment and vehicles are expected to be moved on-site during the initial construction phase and removed during the final construction phase; thus, daily truck trips would not be generated. Additionally, daily transportation of construction workers would not represent a substantial percentage of current daily traffic volumes along access routes.

Operating and maintaining the proposed water facilities would not require onsite full time staff, since the AWTP would operate automatically with no operators onsite. Up to two employees would visit the site daily to visually inspect and maintain the AWTP.

Therefore, given the short duration of construction activities, the nature and scope of the proposed water facilities, and since traffic volumes associated with the proposed facilities would be nominal, Project implementation would not conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system. The Project would not significantly impact intersections, streets, highways, freeways, mass transit, or Congestion Management Program (CMP) facilities. Additionally, the Project would not impact pedestrian or bicycle paths, since none are located on or immediately adjacent to the Project site.

MITIGATION MEASURES

No mitigation is required.

4.16.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?

No Impact. Given the nature and scope of the proposed water facilities, the Project would not result in any change in air traffic patterns or traffic levels.

MITIGATION MEASURES

No mitigation is required.

4.16.d Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

No Impact. The Project does not involve construction of transportation-related or other improvements that would increase hazards.

The Project site is designated Agriculture (AG) and the proposed water facilities (Public Utility Facilities)[1] are allowable uses in AG-designated sites, according to Coastal Table O. Additionally, the proposed water facilities would be constructed within an existing public utility site that already contains the San Simeon well field, percolation pond system, and Van Gordon Reservoir. Therefore, the Project would not substantially increase hazards due to incompatible uses.

MITIGATION MEASURES

No mitigation is required.

[1] Public Utility Facilities [J5] include public water system wells, treatment plants, and storage, and community wastewater treatment plants, settling ponds, and disposal fields, among other (see Coastal Zone Framework for Planning Excerpts Land Use Definitions).

4.16.e Result in inadequate emergency access?

No Impact. Access to the Project site would continue to be provided along the northern site boundary, via San Simeon - Monterey Creek Road. The Project would not result in inadequate emergency access.

MITIGATION MEASURES

No mitigation is required.

4.16.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 Project does not involve the construction of public transit, bicycle, or pedestrian facilities. Housing and employment-generating land uses are not proposed, thus, the Project does not create a demand for new public transit, bicycle, or pedestrian facilities. Additionally, there are no public transit, bicycle, or pedestrian facilities located on or immediately adjacent to the Project site. Therefore, the Project would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

MITIGATION MEASURES

No mitigation is required.

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4.17 UTILITIES AND SERVICE SYSTEMS

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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?				✓

IMPACT ANALYSIS

4.17.a Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?

Less Than Significant Impact. A stream of the AWTP product water would be pumped southwest of the AWTP for discharge into San Simeon Creek via LIWs, which are proposed just upstream of the fresh water lagoon, approximately 2,500 feet southwest of existing Well 9P7.

The Project proposes to extract 400 gallons per minute (gpm) of groundwater from the San Simeon Creek aquifer (via Well 9P7) upstream of San Simeon Creek Lagoon. The extracted water would be treated at the proposed AWTP and 300 gpm would be reinjected (via RIW) for subsequent distribution to Cambria. To mitigate the extraction of groundwater, the Project proposes to return 100 gpm to the San Simeon Creek aquifer adjacent to the Lagoon (via LIWs or via existing Well 9P7 discharge pipeline directly into Van Gordon Creek adjacent to the AWTP). The AWTP generated waste stream (brine) would be disposed of via evaporation within the existing Van Gordon Reservoir, after it is modified to meet Title 27 requirements, which include an impermeable liner system and monitoring system to protect soil and groundwater. Evaporation of the brine waste stream would be aided with mechanical spray evaporators.

As concluded in Response 4.9.a, review of the Project through the established regulatory framework would ensure the ROWD contains the necessary technical information in support of a WDR Permit to protect the nearby surface, coastal, and ground waters (Waters of the State). Compliance with LCP Policies 16, 20, 21, and 23 would be

achieved through compliance with CZLUO and CCRWQCB requirements. Compliance with the established regulatory framework would ensure the Project would result in a less than significant impact involving potential exceedances of wastewater treatment requirements.

EXISTING REGULATIONS

Refer to Response 4.9.a and the following.

Local Coastal Program Policies:

Wetlands

LCP 16 Adjacent Development. Development adjacent to coastal wetlands shall be sited and designed to prevent significant impacts to wetlands through noise, sediment or other disturbances. Development shall be located as far away from the wetland as feasible, consistent with other habitat values on the site.

Coastal Streams

LCP 20 Coastal Streams and Riparian Vegetation. Coastal streams and adjoining riparian vegetation are environmentally sensitive habitat areas and the natural hydrological system and ecological function of coastal streams shall be protected and preserved.

LCP 21 Development in or Adjacent to a Coastal Stream. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 23 County and State Review of Coastal Stream Projects. The State Water Resources Control Board and the County shall ensure that the beneficial use of coastal stream waters is protected, for projects over which it has jurisdiction… .

MITIGATION MEASURES

Refer to Response 4.9.a.

4.17.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?

Less Than Significant With Mitigation Incorporated.

Water Infrastructure and Water Treatment Facilities

The CCSD is proposing the Cambria Emergency Water Supply Project, as described in Section 2.4, Project Characteristics. The emergency Project is needed to: fully recharge one of the two coastal stream aquifers, in order to: avoid projected water supply shortages by the end of summer 2014; prevent seawater intrusion into the groundwater aquifer and possible subsidence; and protect well pumps from losing suction. The emergency Project is the subject of this Initial Study. Therefore, the Project would result in construction of new water and water treatment facilities, the construction and operation of which could cause environmental effects. As concluded in Sections 4.1 through 4.18, the Project would result in less than significant impacts with mitigation incorporated.

Wastewater Infrastructure and Wastewater Treatment Facilities

The Project does not involve development of land uses that would generate wastewater; therefore, the Project would not require or result in the construction of new wastewater or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects. Refer also to Response 4.17.a above.

EXISTING REGULATIONS

Local Coastal Program Policies: Refer to LCP Policies specified in Sections 4.1 through 4.18.

North Coast Area Plan Standards: Refer to NCAP standards specified in Sections 4.1 through 4.18.

Coastal Zone Land Use Ordinance Standards: Refer to CZLUO standards specified in Sections 4.1 through 4.18.

MITIGATION MEASURES

Refer to Mitigation Measures specified in Sections 4.1 through 4.18.

4.17.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?

No Impact. Due to the Project's nature and scope, construction of new storm water drainage facilities or the expansion of existing facilities would not be required. Refer also to Responses 4.9.c and 4.9.d.

MITIGATION MEASURES

No mitigation is required.

4.17.d Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?

Less Than Significant Impact. The Project does not involve development of land uses that would create a demand for water. Rather, the CCSD is proposing the Cambria Emergency Water Supply Project in response to the CCSD Board of Directors' January 30, 2014 declaration of a Stage 3 Water Shortage Emergency in Cambria. Thus, the Project involves construction and operation of water facilities that are needed to address an emergency condition resulting from the current drought emergency and avoid future water shortage emergencies; also see Response 4.13.a. Because the Project does not involve development of land uses that would create a demand for water, new or expanded entitlements are not needed.

MITIGATION MEASURES

No mitigation is required.

4.17.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 generation in addition to the provider's existing commitments?

No Impact. The Project does not involve development of land uses that would generate wastewater; therefore, the Project would not impact the capacity of CCSD's wastewater treatment facility. Refer also to Responses 4.17.a and 4.17.b above.

MITIGATION MEASURES

No mitigation is required.

4.17.f Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?

4.17.g Comply with federal, state, and local statutes and regulations related to solid waste?

No Impact. The Project does not involve development of land uses that would generate solid waste; therefore, the Project would not impact a landfill's capacity or conflict with solid waste regulations. Refer to Response 4.8.a regarding the Project's brine disposal requirements.

MITIGATION MEASURES

No mitigation is required.

4.18 MANDATORY FINDINGS OF SIGNIFICANCE

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
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?			✓	

IMPACT ANALYSIS

4.18.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?

Less Than Significant With Mitigation Incorporated. As concluded in Section 4.4, *Biological Resources*, the Project has 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. Impacts in this regard would be less than significant with mitigation incorporated.

As concluded in Section 4.5, *Cultural Resources*, the Project does not have the potential to eliminate important examples of the major periods of California history or prehistory. Impacts to cultural resources would be less than significant impact with mitigation incorporated.

MITIGATION MEASURES

No mitigation is required.

4.18.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)?

***Less Than Significant Impact*.** Based on the analysis contained in this Initial Study, the Project, with implementation of the mitigation measures identified in Sections 4.1 through 4.17, would not have cumulatively considerable impacts. As such, implementation of mitigation measures at the Project-level would reduce the potential for the Project's incremental effects to be considerable when viewed in connection with the effects of past projects, current projects, or probable future projects.

MITIGATION MEASURES

No mitigation is required.

4.18.c Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

***Less Than Significant Impact*.** Previous sections of this Initial Study analyzed the Project's potential impacts related to aesthetics, air quality, geology and soils, hazards and hazardous materials, hydrology and water quality, noise, and public services and utilities. As concluded in these previous discussions, the Project would result in less than significant environmental impacts with implementation of the recommended mitigation. Therefore, the Project would not result in environmental impacts that would cause substantial adverse effects on human beings.

MITIGATION MEASURES

No mitigation is required.

5.0 REFERENCES

The following references were utilized during preparation of this Initial Study. These documents are available for review at the Cambria Community Services District (CCSD) located at 1316 Tamson Drive, Suite 201, Cambria, California 9342.

1. Boyle Engineering Corporation, *Preliminary Draft EIR for Proposed Van Gordon Creek Effluent Reservoir for Cambria Community Services District*, June 1979.

2. California Department of Forestry and Fire Protection, *Fire Resource and Assessment Program State Responsibility Area Maps,* http://frap.fire.ca.gov/data/frapgismaps/sra_map_download.html.

3. California Energy Commission, *California Greenhouse Gas Inventory for 2000-2011*, August 2013.

4. California Environmental Quality Act, 1970, as amended, Public Resources Code Sections 21000-21178.

5. California Health and Safety Code Section 7050.5.

6. California Public Resources Code Section 5097.98 – 5097.99.

7. CDM Smith, *Cambria Emergency Water Supply Project San Simeon Creek Basin Groundwater Modeling Report*, May 14, 2014.

8. CDM Smith, *Cambria Emergency Water Supply Project Description*, June 2014.

9. CDM Smith, *Cambria Water Supply Alternatives Engineering Technical Memorandum*, November 27, 2013.

10. Coastal Valley Engineering, Inc., *Draft EIR for Cambria County Water District Water System Improvements*, May 1976.

11. Cogstone, Cultural Resources Assessment for the Cambria Emergency Water Project, June 2014.

12. County of San Luis Obispo, *Building and Construction Ordinance*, Revised January 2013.

13. County of San Luis Obispo, *Coastal Plan Policies, Local Coastal Program Policy Document, A Portion of the San Luis Obispo County Land Use Element of the General Plan*, Revised April 2007.

14. County of San Luis Obispo, *Coastal Zone Land Use Ordinance*, Revised November 2013.

15. County of San Luis Obispo, *General Plan*, 1992-2010.

16. County of San Luis Obispo, *Energy Wise Plan Designing Energy and Climate Solutions for the Future,* November 2011.

17. County of San Luis Obispo, *Framework for Planning Coastal Zone,* Revised November 2011.

18. County of San Luis Obispo, *Municipal Code,* Codified through Ordinance No. 3235, Passed November 20, 2012.

19. County of San Luis Obispo, *Natural Hazard Maps*.

20. County of San Luis Obispo, *Noise Element, Part I Policy Document,* Adopted May 5, 1992.

21. County of San Luis Obispo, *North Coast Area Plan*, Revised August 24, 2008.

22. County of San Luis Obispo Website, http://www.slocounty.ca.gov/planning/zoning/Map_Image_Download_ Center/Land_Use_ Maps.htm, Accessed May 15, 2014.

23. County of San Luis Obispo Website, http://www.slocounty.ca.gov/planning/zoning/Map_Image_Download _Center/Natural_Resources_Maps.htm, Accessed May 16, 2014.

24. Department of Conservation Division of Mines and Geology, *A General Location Guide for Ultramafic Rocks in California – Areas More Likely to Contain Naturally Occurring Asbestos Report,* August 2000.

25. Federal Highway Administration, *Roadway Construction Noise Model (Federal Highway Administration-HEP-05-054),* January 2006.

26. Google Earth, 2014.

27. Harris, Cyril, Handbook of Noise Control, 1979.

28. RBF Consulting, Cambria Emergency Water Supply Project Habitat Assessment, June 11, 2014.

29. Robert Bein, William Frost & Associates, *Draft Environmental Impact Report and Appendices Effluent Disposal Field and Stream Restoration Improvements Project*, August 1993.

30. Robert Bein, William Frost & Associates, *Groundwater Recharge Project Environmental Impact Report*, December 1991.

31. San Luis Obispo County Air Pollution Control District, *CEQA Air Quality Handbook,* April 2012.

32. San Luis Obispo County Air Pollution Control District Website, http://www.slocleanair.org/index, Accessed June 5, 2014.

33. State of California, Department of Conservation, California Geological Survey, http://www.quake.ca.gov /gmaps/WH/ regulatorymaps.htm, Accessed May 27, 2014.

34. The Airport Land Use Commission of San Luis Obispo County, *Airport Land Use Plan for the San Luis Obispo County Regional Airport,* Amended May 18, 2005.

35. United States Environmental Protection Agency, Risk Management Planning Rule 40 CFR 68.

36. United States Environmental Protection Agency Website, *Greenhouse Gas Equivalencies Calculator*, http://www.epa.gov/cleanenergy/energy-resources/calculator.html, Accessed June 9, 2014.

37. Written Communication: Robert C. Gresens, P.E., District Engineer, Cambria Community Services District, June 5, 2014.

6.0 REPORT PREPARATION PERSONNEL

Cambria Community Services District (Lead Agency)
1316 Tamson Drive, Suite 201
Cambria, California 9342

Mr. Robert C. Gresens, P.E., District Engineer
Mr. Jerry Gruber

CDM Smith (Consulting Engineer)
111 Academy Way, Suite 150
Irvine, California 92617

Mr. Sava S. Nedic, P.E., PMP, BCEE, Principal
Mr. Chris Park, AICP, LEED AP BD+C, Planner
Ms. Evelyn You, P.E., Environmental Engineer

RBF Consulting, a Company of Michael Baker International (Lead Consultant)
14725 Alton Parkway
Irvine, California 92618

Mr. Glenn Lajoie, AICP, Project Director
Ms. Rita Garcia, Project Manager
Mr. Eddie Torres, INCE, Director of Technical Studies
Mr. Thomas McGill, Biologist
Mr. Ryan Winkleman, Biologist
Mr. Travis McGill, Biologist
Mr. Achilles Malisos, Air Quality, Greenhouse Gas, and Noise Analyst
Ms. Alesia Hsiao, Air Quality, Greenhouse Gas, and Noise Analyst
Ms. Linda Bo, Document Preparation/Graphic Artist

Cogstone (Cultural Assessment)
1518 West Taft Avenue
Orange, California 92865

Ms. Sherri Gust, Principal

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7.0 INVENTORY EXISTING REGULATIONS AND PROJECT MITIGATION MEASURES

7.1 LOCAL COASTAL PROGRAM POLICIES

AESTHETICS

Visual and Scenic Resources

LCP 1 Protection of Visual and Scenic Resources. Unique and attractive features of the landscape, including but not limited to unusual landforms, scenic vistas and sensitive habitats are to be preserved protected, and in visually degraded areas restored where feasible.

LCP 2 Site Selection for New Development. Permitted development shall be sited so as to protect views to and along the ocean and scenic coastal areas. Wherever possible, site selection for new development is to emphasize locations not visible from major public view corridors….

LCP 4 New Development in Rural Areas. New development shall be sited to minimize its visibility from public view corridors. Structures shall be designed (height, bulk, style) to be subordinate to, and blend with, the rural character of the area. New development which cannot be sited outside of public view corridors is to be screened utilizing native vegetation; however, such vegetation, when mature, must also be selected and sited in such a manner as to not obstruct major public views. New land divisions whose only building site would be on a highly visible slope or ridgetop shall be prohibited.

LCP 7 Preservation of Trees and Native Vegetation. The location and design of new development shall minimize the need for tree removal. When trees must be removed to accommodate new development or because they are determined to be a safety hazard, the site is to be replanted with similar species or other species which are reflective of the community character.

BIOLOGICAL RESOURCES

Environmentally Sensitive Habitats

LCP 1 Land Uses Within or Adjacent to Environmentally Sensitive Habitats. New development within or adjacent to locations of environmentally sensitive habitats (within 100 feet unless sites further removed would significantly disrupt the habitat) shall not significantly disrupt the resource. Within an existing resource, only those uses dependent on such resources shall be allowed within the area.

LCP 2 Permit Requirement. As a condition of permit approval, the applicant is required to demonstrate that there will be no significant impact on sensitive habitats and that proposed development or activities will be consistent with the biological continuance of the habitat. This shall include an evaluation of the site prepared by a qualified professional which provides: a) the maximum feasible mitigation measures (where appropriate), and b) a program for monitoring and evaluating the effectiveness of mitigation measures where appropriate.

Wetlands

LCP 7 Protection of Environmentally Sensitive Habitats. Coastal wetlands are recognized as environmentally sensitive habitat areas. The natural ecological functioning and productivity of wetlands and estuaries shall be protected, preserved and where feasible, restored.

LCP 16 Adjacent Development. Development adjacent to coastal wetlands shall be sited and designed to prevent significant impacts to wetlands through noise, sediment or other disturbances. Development shall be located as far away from the wetland as feasible, consistent with other habitat values on the site.

LCP 17 Wetland Buffer. In new development, a buffer strip shall be required and maintained in natural condition along the periphery of all wetlands. This shall be a minimum of 100 feet in width measured from the upland extent of the wetland unless a more detailed requirement for a greater or lesser amount is included in the LUE or the LUO would allow for adjustment to recognize the constraints which the minimum buffer would impose upon existing subdivided lots. If a project involves substantial improvements or increased human impacts, necessitating a wide buffer area, it shall be limited to utility lines, pipelines, drainage and flood control facilities, bridges and road approaches to bridges, and roads when it can be demonstrated that: a) alternative routes are infeasible or more environmentally damaging, and b) the adverse environmental effects are mitigated to the maximum extent feasible. Access paths and/or fences necessary to protect habitats may also be permitted.

The minimum buffer strip may be adjusted by the county if the minimum setback standard would render the parcel physically unusable for the principal permitted use. To allow a reduction in the minimum standard set-back, it must be found that the development cannot be designed to provide for the standard. When such reductions are permitted, the minimum standard shall be reduced to only the point at which the principal permitted use (development), modified as much as is practical from a design standpoint, can be accommodated. At no point shall this buffer be less than 25 feet.

LCP 18 Wetland Buffers Less than 100 Feet. For buffers less than 100 feet as established consistent with Policy 15 (above) mitigation measures to ensure wetland protection shall be required, and shall include (where applicable) vegetative screening, landscaping with native vegetation, drainage controls and other such measures.

When the minimum buffer strip is adjusted by the county, it shall be done on a case-by-case basis only after the investigation of the following factors:

a. Soil type and stability of development site, including susceptibility to erosion.
b. Slope of land adjacent to the wetland and the ability to use natural topographic features to locate development.
c. Types and amount of vegetation and its value as wildlife habitat including: 1) the biological significance of the adjacent lands in maintaining the functional capacity of the wetland, and 2) the sensitivity of the species to disturbance.
d. Type and intensity of proposed uses.
e. Lot size and configuration, and the location of existing development.

Coastal Stream

LCP 20 Coastal Streams and Riparian Vegetation. Coastal streams and adjoining riparian vegetation are environmentally sensitive habitat areas and the natural hydrological system and ecological function of coastal streams shall be protected and preserved.

LCP 21 Development in or Adjacent to a Coastal Stream. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 28 Buffer Zone for Riparian Habitats. In rural areas (outside the USL) a buffer setback zone of 100 feet shall be established between any new development (including new agricultural development) and the upland edge of riparian habitats. In urban areas this minimum standard shall be 50 feet except where a lesser buffer is specifically permitted. The buffer zone shall be maintained in natural condition along the periphery of all streams. Permitted uses within the buffer strip shall be limited to passive recreational, educational or existing nonstructural agricultural developments in accordance with adopted best management practices. Other uses that may be found appropriate are limited to utility lines, pipelines, drainage and flood control facilities, bridges and road approaches to bridges to cross a stream and roads when it can be demonstrated that: 1) alternative routes are infeasible or more environmentally damaging and 2) adverse environmental effects are mitigated to the maximum extent feasible. Lesser setbacks on existing parcels may be permitted if application of the minimum setback standard would render the parcel physically unusable for the principal permitted use. In allowing a reduction in the minimum setbacks, they shall be reduced only to the point at which a principal permitted use (as modified as much as is practical from a design standpoint) can be accommodated.

Terrestrial Environments

LCP 29 Protection of Terrestrial Habitats. Designated plant and wildlife habitats are environmentally sensitive habitat areas and emphasis for protection should be placed on the entire ecological community. Only uses dependent on the resource shall be permitted within the identified sensitive habitat portion of the site.

Development adjacent to environmentally sensitive habitat areas and holdings of the State Department of Parks and Recreation shall be sited and designed to prevent impacts that would significantly degrade such areas and shall be compatible with the continuance of such habitat areas.

LCP 30 Protection of Native Vegetation. Native trees and plant cover shall be protected wherever possible. Native plants shall be used where vegetation is removed.

LCP 35 Protection of Vegetation. Vegetation which is rare or endangered or serves as cover for endangered wildlife shall be protected against any significant disruption of habitat value. All development shall be designed to disturb the minimum amount possible of wildlife or plant habitat.

CULTURAL RESOURCES

LCP 1 Protection of Archaeological Resources. The county shall provide for the protection of both known and potential archaeological resources. All available measures, including purchase, tax relief, purchase of development rights, etc., shall be explored at the time of a development proposal to avoid development on important archaeological sites. Where these measures are not feasible and development will adversely affect identified archaeological or paleontological resources, adequate mitigation shall be required.

LCP 3 Identification of Archaeological Sites. ….. Development within an archaeological sensitive areas shall not occur until a preliminary site survey is conducted for the site, and if necessary, mitigation measures implemented.

LCP 5 Mitigation Techniques for Preliminary Site Survey Before Construction. Where substantial archaeological resources are found as a result of a preliminary site survey before construction, the county shall require a mitigation plan to protect the site. Some examples of specific mitigation techniques include:

a. Project redesign could reduce adverse impacts of the project through relocation of open space, landscaping or parking facilities.

b. Preservation of an archaeological site can sometimes be accomplished by covering the site with a layer of fill sufficiently thick to insulate it from impact. This surface can then be used for building that does not require extensive foundations or removal of all topsoil.

c. When a project impact cannot be avoided, it may be necessary to conduct a salvage operation. This is usually a last resort alternative because excavation, even under the best conditions, is limited by time, costs and technology. Where the chosen mitigation measure necessitates removal of archaeological resources, the county shall require the evaluation and proper deposition of the findings based on consultation with a qualified archaeologist knowledgeable in the Chumash culture.

d. A qualified archaeologist knowledgeable in the Chumash culture may need to be on-site during initial grading and utility trenching for projects within sensitive areas.

GEOLOGY AND SOILS

Hazards

LCP 1 New Development. All new development proposed within areas subject to natural hazards from geologic or flood conditions (including beach erosion) shall be located and designed to minimize risks to human life and property….

LCP 2 Erosion and Geologic Stability. New development shall ensure structural stability while not creating or contributing to erosion or geological instability.

LCP 3 Development Review in Hazard Areas. The County shall require a detailed review of development proposed within the geologic study area and flood hazard combining designations as indicated on the Land Use Element maps for the coastal zone. The review shall be performed by a qualified registered and/or certified engineering geologist and shall be adequately detailed to provide recommendations and conclusions consistent with this plan….

Coastal Streams

LCP 20 Coastal Streams and Riparian Vegetation. Coastal streams and adjoining riparian vegetation are environmentally sensitive habitat areas and the natural hydrological system and ecological function of coastal streams shall be protected and preserved.

LCP 21 Development in or Adjacent to a Coastal Stream. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 23 County and State Review of Coastal Stream Projects. The State Water Resources Control Board and the County shall ensure that the beneficial use of coastal stream waters is protected, for projects over which it has jurisdiction. For projects which do not fall under the review of the State Water Resources Control Board, the County (in its review of public works and stream alterations) shall ensure that the quantity and quality surface water discharge from streams and rivers shall be maintained at levels necessary to sustain the functional capacity of streams, wetland, estuaries and lakes.

LCP 28 Buffer Zone for Riparian Habitats. In rural areas (outside the USL) a buffer setback zone of 100 feet shall be established between any new development (including new agricultural development) and the upland edge of riparian habitats. In urban areas this minimum standard shall be 50 feet except where a lesser buffer is specifically permitted. The buffer zone shall be maintained in natural condition along the periphery of all streams. Permitted uses within the buffer strip shall be limited to passive recreational, educational or existing nonstructural agricultural developments in accordance with adopted best management practices. Other uses that may be found appropriate are limited to utility lines, pipelines, drainage and flood control facilities, bridges and road approaches to bridges to cross a stream and roads when it can be demonstrated that: 1) alternative routes are infeasible or more environmentally damaging and 2) adverse environmental effects are mitigated to the maximum extent feasible. Lesser setbacks on existing parcels may be permitted if application of the minimum setback standard would render the parcel physically unusable for the principal permitted use. In allowing a reduction in the minimum setbacks, they shall be reduced only to the point at which a principal permitted use (as modified as much as is practical from a design standpoint) can be accommodated.

HYDROLOGY AND WATER QUALITY

Coastal Watersheds

LCP 1 Preservation of Groundwater Basins. The long-term integrity of groundwater basins within the coastal zone shall be protected. The safe yield of the groundwater basin, including return and retained water, shall not be exceeded except as part of a conjunctive use or resource management program which assures that the biological productivity of aquatic habitats are not significantly adversely impacted.

LCP 2 Water Extractions. Extractions, impoundments, and other water resource developments shall obtain all necessary county and/or state permits. All pertinent information on these uses (including water conservation opportunities and impacts on in-stream beneficial uses) will be incorporated into the data base for the Resource Management System and shall be supplemented by all available private and public water resources studies available. Groundwater levels and surface flows shall be maintained to ensure that the quality of coastal waters, wetlands, and streams is sufficient to provide for optimum populations of marine organisms, and for the protection of human health.

Wetlands

LCP 16 Adjacent Development. Development adjacent to coastal wetlands shall be sited and designed to prevent significant impacts to wetlands through noise, sediment or other disturbances. Development shall be located as far away from the wetland as feasible, consistent with other habitat values on the site.

Coastal Streams

LCP 20 Coastal Streams and Riparian Vegetation. Coastal streams and adjoining riparian vegetation are environmentally sensitive habitat areas and the natural hydrological system and ecological function of coastal streams shall be protected and preserved.

LCP 21 Development in or Adjacent to a Coastal Stream. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 23 County and State Review of Coastal Stream Projects. The State Water Resources Control Board and the County shall ensure that the beneficial use of coastal stream waters is protected, for projects over which it has jurisdiction. For projects which do not fall under the review of the State Water Resources Control Board, the county (in its review of public works and stream alterations) shall ensure that the quantity and quality surface water discharge from streams and rivers shall be maintained at levels necessary to sustain the functional capacity of streams, wetland, estuaries and lakes.

Hazards

LCP 1 New Development. All new development proposed within areas subject to natural hazards from geologic or flood conditions (including beach erosion) shall be located and designed to minimize risks to human life and property……

LCP 2 Erosion and Geologic Stability. New development shall ensure structural stability while not creating or contributing to erosion or geological instability.

LCP 3 Development Review in Hazard Areas. The County shall require a detailed review of development proposed within the geologic study area and flood hazard combining designations as indicated on the Land Use Element maps for the coastal zone. The review shall be performed by a qualified registered and/or certified engineering geologist and shall be adequately detailed to provide recommendations and conclusions consistent with this plan. Residential, commercial and industrial development shall be prohibited within the l00 year floodplain (one percent (1%) chance of inundation in any year) as delineated in the Flood Hazard combining designation except for those areas within an urban reserve line.

LAND USE AND PLANNING

Environmentally Sensitive Habitats

LCP 1 Land Uses Within or Adjacent to Environmentally Sensitive Habitats. New development within or adjacent to locations of environmentally sensitive habitats (within 100 feet unless sites further removed would significantly disrupt the habitat) shall not significantly disrupt the resource. Within an existing resource, only those uses dependent on such resources shall be allowed within the area.

LCP 2 Permit Requirement. As a condition of permit approval, the applicant is required to demonstrate that there will be no significant impact on sensitive habitats and that proposed development or activities will be consistent with the biological continuance of the habitat. This shall include an evaluation of the site prepared by a qualified professional which provides: a) the maximum feasible mitigation measures (where appropriate), and b) a program for monitoring and evaluating the effectiveness of mitigation measures where appropriate.

Wetlands

LCP 16 *Adjacent Development*. Development adjacent to coastal wetlands shall be sited and designed to prevent significant impacts to wetlands through noise, sediment or other disturbances. Development shall be located as far away from the wetland as feasible, consistent with other habitat values on the site.

Coastal Streams

LCP 21 Development in or Adjacent to a Coastal Stream. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 28 Buffer Zone for Riparian Habitats. In rural areas (outside the USL) a buffer setback zone of 100 feet shall be established between any new development (including new agricultural development) and the upland edge of riparian habitats. In urban areas this minimum standard shall be 50 feet except where a lesser buffer is specifically permitted. The buffer zone shall be maintained in natural condition along the periphery of all streams. Permitted uses within the buffer strip shall be limited to passive recreational, educational, or existing nonstructural agricultural developments in accordance with adopted best management practices. Other uses that may be found appropriate are limited to utility lines, pipelines, drainage and flood control facilities, bridges and road approaches to bridges to cross a stream and roads when it can be demonstrated that: 1) alternative routes are infeasible or more environmentally damaging and 2) adverse environmental effects are mitigated to the maximum extent feasible. Lesser setbacks on existing parcels may be permitted if application of the minimum setback standard would render the parcel physically unusable for the principal permitted use. In allowing a reduction in the minimum setbacks, they shall be reduced only to the point at which a principal permitted use (as modified as much as is practical from a design standpoint) can be accommodated.

Terrestrial Environments

LCP 29 Protection of Terrestrial Habitats. Designated plant and wildlife habitats are environmentally sensitive habitat areas and emphasis for protection should be placed on the entire ecological community. Only uses dependent on the resource shall be permitted within the identified sensitive habitat portion of the site.

Development adjacent to environmentally sensitive habitat areas and holdings of the State Department of Parks and Recreation shall be sited and designed to prevent impacts that would significantly degrade such areas and shall be compatible with the continuance of such habitat areas.

Visual and Scenic Resources

LCP 2 Site Selection for New Development. Permitted development shall be sited so as to protect views to and along the ocean and scenic coastal areas. Wherever possible, site selection for new development is to emphasize locations not visible from major public view corridors. In particular, new development should utilize slope created "pockets" to shield development and minimize visual intrusion.

LCP 4 New Development in Rural Areas. New development shall be sited to minimize its visibility from public view corridors. Structures shall be designed (height, bulk, style) to be subordinate to, and blend with, the rural character of the area. New development which cannot be sited outside of public view corridors is to be screened utilizing native vegetation; however, such vegetation, when mature, must also be selected and sited in such a manner as to not obstruct major public views. New land divisions whose only building site would be on a highly visible slope or ridgetop shall be prohibited.

LCP 7 Preservation of Trees and Native Vegetation. The location and design of new development shall minimize the need for tree removal.

UTILITIES AND SERVICE SYSTEMS

Wetlands

LCP 16 Adjacent Development. Development adjacent to coastal wetlands shall be sited and designed to prevent significant impacts to wetlands through noise, sediment or other disturbances. Development shall be located as far away from the wetland as feasible, consistent with other habitat values on the site.

Coastal Streams

LCP 20 Coastal Streams and Riparian Vegetation. Coastal streams and adjoining riparian vegetation are environmentally sensitive habitat areas and the natural hydrological system and ecological function of coastal streams shall be protected and preserved.

LCP 21 Development in or Adjacent to a Coastal Stream. Development adjacent to or within the watershed (that portion within the coastal zone) shall be sited and designed to prevent impacts which would significantly degrade the coastal habitat and shall be compatible with the continuance of such habitat areas. This shall include evaluation of erosion and runoff concerns.

LCP 23 County and State Review of Coastal Stream Projects. The State Water Resources Control Board and the County shall ensure that the beneficial use of coastal stream waters is protected, for projects over which it has jurisdiction… .

7.2 NORTH COAST AREA PLAN STANDARDS

AESTHETICS

Site Design and Building Construction

AW-6 Site Selection. Primary site selection for new development shall be locations not visible from Highway 1 as follows:

a. Sites shall be selected where hills and slopes would shield development unless no alternative location exists or the new development provides visitor-serving facilities.

b. New development shall be located so that no portion of a structure extends above the highest horizon line of ridgelines as seen from Highway 1.

LAND USE AND PLANNING

Site Design and Building Construction

AW-6 Site Selection. Primary site selection for new development shall be locations not visible from Highway 1 as follows:

a. Sites shall be selected where hills and slopes would shield development unless no alternative location exists or the new development provides visitor-serving facilities.

b. New development shall be located so that no portion of a structure extends above the highest horizon line of ridgelines as seen from Highway 1.

7.3 COASTAL ZONE LAND USE ORDINANCE STANDARDS

AESTHETICS

Chapter 23.04 (Site Design Standards). This Chapter establishes standards for the design and layout of sites for land uses. The purpose of these standards is to support, through careful site evaluation and design, the establishment of land uses in a manner that is compatible with existing land uses and neighborhoods, and the natural environment. Standards are provided for the following site development features that are relevant to visual resources:

- Parcel size;
- Minimum site area;
- Setbacks;
- Heights; and
- Fencing and screening.

Section 23.04.320 (Outdoor Lights). This Section establishes standards relative to the following lighting features that are applicable to all outdoor night-lighting sources:

- Illumination;
- Light directed onto lot;
- Minimization of light intensity;
- Light sources to be shielded;
- Ground illuminating lights;
- Elevated feature illumination;
- Height of light fixtures; and
- Street lighting.

BIOLOGICAL RESOURCES

Section 23.07.160 (Sensitive Resource Area (SRA)). The Sensitive Resource Area combining designation is applied to identify areas with special environmental qualities, or areas containing unique or endangered vegetation or habitat resources. The purpose of these combining designation standards is to require that proposed uses be designed with consideration of the identified sensitive resources, and the need for their protection, and, where applicable, to satisfy the requirements of the California Coastal Act.

Section 23.07.166 (Minimum Site Design and Development Standards). All uses within a Sensitive Resource Area shall conform to the following standards:

c. Construction and landscaping activities shall be conducted to not degrade lakes, ponds, wetlands, or perennial watercourses within an SRA through filling, sedimentation, erosion, increased turbidity, or other contamination.

e. Where an SRA is applied because of specified species of trees, plants or other vegetation, such species shall not be disturbed by construction activities or subsequent operation of the use, except where authorized by Development Plan approval.

Section 23.07.170 (Environmentally Sensitive Habitats). The provisions of this section apply to development proposed within or adjacent to (within 100 feet of the boundary of) an Environmentally Sensitive Habitat as defined by Chapter 23.11 of this title.

a. Application content. A land use permit application for a project on a site located within or adjacent to an Environmentally Sensitive Habitat shall also include a report by a biologist approved by the Environmental Coordinator.

b. Required findings: Approval of a land use permit for a project within or adjacent to an Environmentally Sensitive Habitat shall not occur unless the applicable review body first finds that:

(1) There will be no significant negative impact on the identified sensitive habitat and the proposed use will be consistent with the biological continuance of the habitat.

(2) The proposed use will not significantly disrupt the habitat.

Section 23.07.174 (Streams and Riparian Vegetation). Coastal streams and adjacent riparian areas are environmentally sensitive habitats. The provisions of this section are intended to preserve and protect the natural hydrological system and ecological functions of coastal streams.

a. Development adjacent to a coastal stream. Development adjacent to a coastal stream shall be sited and designed to protect the habitat and shall be compatible with the continuance of such habitat.

d. Riparian setbacks: New development shall be setback from the upland edge of riparian vegetation the maximum amount feasible. In the rural areas (outside the URL) this setback shall be a minimum of 100 feet. A larger setback will be preferable in both the urban and rural areas depending on parcel configuration, slope, vegetation types, habitat quality, water quality, and any other environmental consideration.

(1) Permitted uses within the setback: Permitted uses are limited to those specified in Section 23.07.172d(1)[1] (for wetland setbacks), provided that the findings required by that section can be made. Additional permitted uses that are not required to satisfy those findings include pedestrian and equestrian trails, and non-structural agricultural uses.

All permitted development in or adjacent to streams, wetlands, and other aquatic habitats shall be designed and/or conditioned to prevent loss or disruption of the habitat, protect water quality, and maintain or enhance (when feasible) biological productivity.

Section 23.07.176 (Terrestrial Habitat Protection). The provisions of this section are intended to preserve and protect rare and endangered species of terrestrial plants and animals by preserving their habitats. Emphasis for protection is on the entire ecological community rather than only the identified plant or animal.

a. Protection of vegetation. Vegetation that is rare or endangered, or that serves as habitat for rare or endangered species shall be protected. Development shall be sited to minimize disruption of habitat.

b. Terrestrial habitat development standards:

(1) Revegetation. Native plants shall be used where vegetation is removed.

(2) Area of disturbance. The area to be disturbed by development shall be shown on a site plan. The area in which grading is to occur shall be defined on site by readily-identifiable barriers that will protect the surrounding native habitat areas.

[1] d(1) Permitted uses within wetland setbacks: Within the required setback buffer, permitted uses are limited to passive recreation, educational, existing non-structural agricultural development in accordance with best management practices, utility lines, pipelines, drainage and flood control of facilities, bridges and road approaches to bridges to cross a stream and roads, with certain provisions.

CULTURAL RESOURCES

Chapter 23.04.200 (Protection of Archaeological Resources Not Within the Archaeologically Sensitive Areas Combining Designation). All development applications that propose development that is not located within the Archaeologically Sensitive Areas combining designation and that meets the following location criteria shall be subject to the standards for the Archaeologically Sensitive Areas Combining Designation in Chapter 23.07: development that is either within 100 feet of the bank of a coastal stream (as defined in the CZLUO), or development that is within 300 feet of such stream where the slope of the site is less than 10 percent. [NOTE: Project is within 100 feet of stream; therefore subject to Chapter 23.07).

Chapter 23.05.140 (Archeological Resources Discovery). In the event archeological resources are unearthed or discovered during any construction activities, the following standards apply:

a. Construction activities shall cease, and the Environmental Coordinator and Planning Department shall be notified so that the extent and location of discovered materials may be recorded by a qualified archeologist, and disposition of artifacts may be accomplished in accordance with state and federal law.

b. In the event archeological resources are found to include human remains, or in any other case when human remains are discovered during construction, the County Coroner is to be notified in addition to the Planning Department and Environmental Coordinator so that proper disposition may be accomplished.

Chapter 23.07.104 (Archaeologically Sensitive Areas). To protect and preserve archaeological resources, the following procedures and requirements apply to development within areas of the coastal zone identified as archaeologically sensitive.

a. Archaeologically sensitive areas. The following areas are defined as archaeologically sensitive:

    1. Any parcel within a rural area which is identified on the rural parcel number list prepared by the California Archaeological Site Survey Office on file with the county Planning Department.

    2. Any parcel within an urban or village area which is located within an archaeologically sensitive area as delineated by the official maps (Part III) of the Land Use Element.

    3. Any other parcel containing a known archaeological site recorded by the California Archaeological Site Survey Office.

b. Preliminary site survey required. Before issuance of a land use or construction permit for development within an archaeologically sensitive area, a preliminary site survey shall be required. The survey shall be conducted by a qualified archaeologist knowledgeable in local Native American culture and approved by the Environmental Coordinator. The County will provide pertinent project information to the Native American tribe(s).

c. When a mitigation plan is required. If the preliminary site survey determines that proposed development may have significant effects on existing, known or suspected archaeological resources, a plan for mitigation shall be prepared by a qualified archaeologist. The County will provide pertinent project information to the Native American tribe(s) as appropriate. The purpose of the plan is to protect the resource. The plan may recommend the need for further study, subsurface testing, monitoring during construction activities, project redesign, or other actions to mitigate the impacts on the resource. Highest priority shall be given to avoiding disturbance of sensitive resources. Lower priority mitigation measures may include use of fill to cap the sensitive resources. As a last resort, the review authority may permit excavation and recovery of those resources. The mitigation

plan shall be submitted to and approved by the Environmental Coordinator, and considered in the evaluation of the development request by the Review Authority.

d. Archeological resources discovery. In the event archeological resources are unearthed or discovered during any construction activities, the standards of Section 23.05.140 of this title shall apply. Construction activities shall not commence until a mitigation plan, prepared by a qualified professional archaeologist reviewed and approved by the Environmental Coordinator, is completed and implemented. The County will provide pertinent project information to the affected Native American tribe(s) and consider comments prior to approval of the mitigation plan. The mitigation plan shall include measures to avoid the resources to the maximum degree feasible and shall provide mitigation for unavoidable impacts. A report verifying that the approved mitigation plan has been completed shall be submitted to the Environmental Coordinator prior to occupancy or final inspection, whichever occurs first.

HYDROLOGY AND WATER QUALITY

Chapter 23.05 (Site Development Standards). This Chapter establishes standards for the preparation of sites for development and construction activities, to protect the health, safety and welfare of persons living on or near a project site by protecting against unwarranted or unsafe grading, or soil erosion resulting from grading; by defining appropriate circumstances for tree removal; by providing for adequate drainage and fire protection facilities; and by identifying appropriate standards for other aspects of site development.

Sections 23.05.022 through 23.05.039. Establish standards for grading and excavation activities to minimize hazards to life and property; protect against erosion and the sedimentation of water courses; and protect the safety, use and stability of public rights-of-way and drainage channels. Additional standards for grading within a Sensitive Resource Area are in Sections 23.07.160 et seq.[2]

Section 23.07.060 - Flood Hazard Area (FH). The Flood Hazard combining designation is applied to areas where terrain characteristics would present new developments and their users with potential hazards to life and property from potential inundation by a 100-year frequency flood or within coastal high hazard areas. These standards are also intended to minimize the effects of development on drainage ways and watercourses.

Section 23.07.062 - Applicability of Flood Hazard Standards. All uses proposed within a Flood Hazard combining designation are subject to the standards of Sections 23.07.064 through 23.07.066, except:

a. Temporary uses: With the approval of the Director of Public Works, the of Planning and Building Director may authorize construction or placement of a temporary structure or use within a Flood Hazard area pursuant to the required land use permit without meeting these standards, provided that the structure or use will not be in place from October 15, to April 15.

b. Emergency work: Emergency work may be undertaken where necessary to preserve life or property. Within 48 hours after commencement of such work, the Director of Public Works is to be notified and an application filed with the Department of Planning and Building in compliance with the provisions of Section 23.07.064.

Section 23.07.064 - Flood Hazard Area Permit and Processing Requirements. Drainage Plan approval is required where any portion of the proposed site is located within a Flood Hazard combining designation, in addition to all other permits required by this title, state, and federal law.

[2] SRAs are addressed in CZLUO Section 23.07.170- not 23.07.160; see Section 4.4, *Biological Resources*.

Section 23.07.065 - General Hazard Avoidance:

a. New Development in Flood Hazard Areas. New structural development, including expansions, additions and improvements to existing development, shall be located outside of the flood hazard areas to the maximum extent feasible. All new structural development located in a flood hazard areas, including expansions, additions, improvements, and repairs to existing development, shall be constructed consistent with the standards set forth in Section 23.07.066.

Section 23.07.066 - Construction Standards:

a. Construction, general: See Standards 1 – 12.

b. Storage and Processing: The storage or processing of materials that in time of flooding are buoyant, flammable, or explosive; that could be injurious to human, animal, or plant life; or that may unduly affect the capacity of the floodway or unduly increase flood heights is not permitted. Storage of other material or equipment may be allowed if not subject to major damage by floods and if firmly anchored to prevent flotation, or if readily removable from the area within the time available after flood warning.

d. Certification of Compliance. The following certifications shall be filed with the Building Official prior to final building inspection:

(1) Upon completion of any structure within a flood hazard combining designation, compliance with elevation requirements shall be certified by a registered civil engineer or licensed land surveyor. Such certification shall include as a minimum the elevation of the lowest floor. If the structure has been flood-proofed in conformance with Section 23.07.066.a(11) above, the certification shall include the elevation to which the structure has been flood-proofed. Elevations shall be based on the National Geodetic Vertical Datum of 1929.

(2) Where flood-proofing is used, a registered civil engineer or architect shall certify that the flood-proofing methods are adequate to withstand the flood depths, pressures, velocities, impact and uplift forces and other factors associated with the 100-year flood.

Section 23.07.174 (Streams and Riparian Vegetation). Coastal streams and adjacent riparian areas are environmentally sensitive habitats. The provisions of this section are intended to preserve and protect the natural hydrological system and ecological functions of coastal streams.

a. Development adjacent to a coastal stream. Development adjacent to a coastal stream shall be sited and designed to protect the habitat and shall be compatible with the continuance of such habitat.

GEOLOGY AND SOILS

Section 23.07.084 (Application Content - Geologic and Soils Report Required). This Section specifies that all land use permit applications for projects located within a Geologic Study Area (except those exempted by Section 23.07.082) shall be accompanied by a report prepared by a certified engineering geologist and/or registered civil engineer (as to soils engineering), as appropriate.

Chapter 23.05 (Site Development Standards). This Chapter establishes standards for the preparation of sites for development and construction activities, to protect the health, safety and welfare of persons living on or near a project site by protecting against unwarranted or unsafe grading, or soil erosion resulting from grading; by defining appropriate circumstances for tree removal; by providing for adequate drainage and fire protection facilities; and by identifying appropriate standards for other aspects of site development.

Section 23.05.020 (Grading). Sections 23.05.022 through 23.05.039 establish standards for grading and excavation activities to minimize hazards to life and property; protect against erosion and the sedimentation of water courses; and protect the safety, use and stability of public rights-of-way and drainage channels. Additional standards for grading within a Sensitive Resource Area are in Sections 23.07.160 et seq.

Section 23.07.174 (Streams and Riparian Vegetation). Coastal streams and adjacent riparian areas are environmentally sensitive habitats. The provisions of this section are intended to preserve and protect the natural hydrological system and ecological functions of coastal streams.

a. Development adjacent to a coastal stream. Development adjacent to a coastal stream shall be sited and designed to protect the habitat and shall be compatible with the continuance of such habitat.

d. Riparian setbacks: New development shall be setback from the upland edge of riparian vegetation the maximum amount feasible. In the rural areas (outside the URL) this setback shall be a minimum of 100 feet. A larger setback will be preferable in both the urban and rural areas depending on parcel configuration, slope, vegetation types, habitat quality, water quality, and any other environmental consideration.

   (1) Permitted uses within the setback: Permitted uses are limited to those specified in Section 23.07.172d(1) (for wetland setbacks), provided that the findings required by that section can be made. Additional permitted uses that are not required to satisfy those findings include pedestrian and equestrian trails, and non-structural agricultural uses. All permitted development in or adjacent to streams, wetlands, and other aquatic habitats shall be designed and/or conditioned to prevent loss or disruption of the habitat, protect water quality, and maintain or enhance (when feasible) biological productivity.

LAND USE AND PLANNING

Section 23.01.031 (Land Use and Coastal Development Permits Required). Pursuant to this Section, no person shall establish, construct, alter, or replace any use of land, structure, or building without first obtaining all permits required by CZLUO Chapter 23.03 or other applicable section of Title 23, except as otherwise provided by Section 23.01.031. Approval of a land use permit pursuant to Title 23 also constitutes approval of a Coastal Development Permit in compliance with the County's LCP and California Coastal Act.

Section 23.01.033 (Consistency With the Land Use Element and Local Coastal Plan Required). This Section specifies that no new use of land, buildings, division of land, or other development shall be established, and no application for such use, land division, or other permit required pursuant to Title 23 shall be approved, unless the proposed use is determined to be allowable in the land use category where the proposed site is located. When an application is accepted for processing, such application shall not be approved unless:

a. The proposed use is identified as an "A", "S" or "P" use by Table O, Part I of the Land Use Element in the land use category where the site for the proposed use is located;

b. The proposed use or division satisfies the standards of the Land Use Element (Part II) applicable to the specific planning area in which the site is located, including any standards may limit the type of land uses or parcel sizes normally allowable in a given land use category;

c. The proposed use or division satisfies any combining designation planning area standards applied to the site by the Land Use Element (Part II), including any such standards that may limit the type of land uses or parcel sizes normally allowable in a given land use category;

d. The proposed use or division satisfies any policies, programs, and standards contained in the Local Coastal Plan Policy Document; and

e. The proposed use or division satisfies the terms, conditions and other requirements of all implementing regulations adopted as part of the Local Coastal Program including but not limited to any categorical exclusion.

Section 23.01.034 (Compliance With Standards Required). This Section specifies that no use of land, buildings, or division of land shall be established and no application for a use of land, buildings, or land division pursuant to County Code Title 21 shall be approved unless the proposed land use, building, or parcels satisfy all applicable requirements of this Code.

Chapter 23.04 (Site Design Standards). This Chapter establishes standards for the design and layout of sites for land uses, new developments, and divisions of land, where allowed by the Land Use Element. The purpose of these standards is to support, through site evaluation and design, the establishment of land uses in a manner that is compatible with existing land uses and neighborhoods; the natural environment; and the health and safety of County residents. Standards are provided for various site development features (parcel size; minimum site area; setbacks; heights; fencing and screening; and outdoor lights, among others).

Section 23.04.050 (Non-Agricultural Uses in the Agriculture Land Use Category). This section establishes permit requirements and standards for non-agricultural uses in the AG category.

b. Supplemental Non-Agricultural Uses.

(1) Supplemental non-agricultural uses defined: Uses allowed by Coastal Table "O" in the Agriculture category that are not directly related to the principal agricultural use on the site.

(3) Permit requirement: Minor use permit approval, unless Development Plan approval is otherwise required by another provision of this title or planning area standard of the Land Use Element.

(4) Required findings: Supplemental non-agricultural uses may be established only if the following findings are made by the applicable approval body:

(i) For prime soils, it has been demonstrated that no alternative project site exists except on prime soils; and
(ii) The least amount of prime soils possible will be converted; and
(iii) The proposed use will not conflict with surrounding agricultural lands and uses.

Chapter 23.05 (Site Development Standards). This Chapter establishes standards for the preparation of sites for development and construction activities, in order to protect against unwarranted or unsafe grading, or soil erosion resulting from grading; by defining appropriate circumstances for tree removal; by providing for adequate drainage and fire protection facilities; and by identifying appropriate standards for other aspects of site development.

Chapter 23.06 (Operational Standards). This Chapter establishes standards to be applied to the operation and conduct of land uses after their establishment, and on a continuing basis. These standards are established to protect from the adverse effects of excessive or objectionable emissions of noise or air contaminants that may be generated by land uses, activities, processes, or equipment.

Chapter 23.07 (Combining Designation Standards). The purpose of Combining Designation standards is to require project design that will give careful consideration to the land features, structures, and activities identified by the Combining Designations.

The Project site is designated with various Combining Designations. Accordingly, the Project would be subject to compliance with the following CZLUO sections:

- San Simeon Creek Flood Hazard (FH): Sections 23.07.060 through 23.07.066;
- Geologic Study Area (GSA): Sections 23.07.080 through 23.07.086;
- Sensitive Resource Area (SRA): Sections 23.07.160 through 23.07.166;
- Environmentally Sensitive Habitat, Terrestrial Habitat (ESH-TH): Section 23.07.176;
- Environmentally Sensitive Habitat, Coastal Creek (ESH-CC): Sections 23.07.170 and 23.07.174;
- Local Coastal Program (LCP): Section 23.07.120.

Chapter 23.08 (Special (S) Uses). The purpose of this Chapter is to establish special additional standards for certain land uses that may affect adjacent properties, the neighborhood, or the community even if the uniform standards of Chapter 23.04 and all other standards of Title 23 are met. Such uses are defined as "S" and "S-P" uses by Coastal Table O, Chapter 7, Part I of the Land Use Element. This Chapter establishes appropriate standards for permit processing, and the location, design, and operation of special uses, to avoid unanticipated problems or hazards, and to assure they will be consistent with the County General Plan.

Section 23.08.280 (Transportation, Utilities, and Communication (S-13)). Transportation and Public Utility Facilities identified as allowable, S-13 uses by the Land Use Element (see Coastal Table 0, Part I of the Land Use Element) are subject to CZLUO Section 23.08.288, *Public Utility Facilities*.

Section 23.08.288 (Public Utility Facilities). The requirements of this section apply to Public Utility Facilities where designated as S-13 uses by Coastal Table "O." Public Utility Facilities (other than electric and communications transmission and natural gas regulation and distribution) require Development Plan approval pursuant to Section 23.02.034, *Development Plan*.

(a) Permit Requirements. In addition to the emergency repair and the general permit requirements of Section 23.08.286 (a) and (b), development plan approval is required for any new facility or modification of any existing facility in the agriculture, rural lands, residential, office and professional, and commercial land use categories. Development plan approval is required for any new facility or modification to any existing facility which would increase the structure heights above those specified in Section 23.04.124 or modify any operational standards causing an increase in any of the categories specified in Chapter 23.06 of this title.

(b) Application Contents. In addition to the application materials required by Chapter 23.02, permit applications shall also include descriptions of:

(1) The proposed design capacity of the facility; the operating schedule; and how the proposed facility interacts with incoming and outgoing utility services.
(2) Plans for any overhead or underground transmission lines, transformers, inverters, switchyards or any required new or upgraded off-site transmission facilities.
(3) Proposed erosion control measures, revegetation, screening and landscaping during construction and operation.
(4) An oil and hazardous material spill contingency plan, including a demonstration that all materials can be contained on-site.
(5) For electric and telephone centers, estimates of the non-ionizing radiation generated and/or received by the facility. These will include estimates of the maximum electric and magnetic field strengths at the edge of the facility site, the extent that measurable fields extend in all directions from the facility.
(6) The number and identification by trades of estimated construction and operation forces. If construction is estimated to take over six months, the construction workforce shall be estimated for each six-month period. The estimates shall include numbers of locally hired employees and

employees who will move into the area, and a discussion of the estimated impact that employees moving into the area will have on housing, schools and traffic.

(c) Development Standards. The following standards apply in addition to any that may be established as conditions of approval:

(1) Environmental Quality Assurance. An environmental quality assurance program covering all aspects of construction and operation shall be submitted prior to construction of any project component. This program will include a schedule and plan for monitoring and demonstrating compliance with all conditions required by the development plan. Specific requirements of this environmental quality assurance program will be determined during the environmental review process and development plan review and approval process.

(2) Clearing and Revegetation. The land area exposed and the vegetation removed during construction shall be the minimum necessary to install and operate the facility. Topsoil will be stripped and stored separately. Disturbed areas no longer required for operation will be regraded, covered with topsoil and replanted during the next appropriate season.

(3) Fencing and Screening. Public utility facilities shall be screened on all sides. An effective visual barrier will be established through the use of a solid wall, fencing and/or landscaping. The adequacy of the proposed screening will be determined during the land use permitting process.

(d) Limitation on Use, Sensitive Environmental Areas. Uses shall not be allowed in sensitive areas such as on prime agricultural soils, sensitive resource areas, environmentally sensitive habitats, or hazard areas, unless a finding is made by the applicable approval body that there is no other feasible location on or off-site the property. Applications for public utility facilities in the above sensitive areas shall include a feasibility study, prepared by a qualified professional approved by the environmental coordinator. The feasibility study shall include a constraints analysis, and analyze alternative locations.

NOISE

Chapter 23.06 (Operational Standards). This Chapter establishes standards to be applied to the operation and conduct of land uses after their establishment, and on a continuing basis. These standards are established to protect residents from the adverse effects of excessive or objectionable emissions of noise that may be generated by land uses, activities, processes or equipment. The purpose of this chapter is also to identify acceptable levels of noise and other emissions in various land use categories, and to set forth procedures for coordinating the review of development projects with the APCD.

Section 23.06.040 (Noise Standards). CZLUO Sections 23.06.044 through 23.06.050 establish standards for acceptable exterior and interior noise levels and describe how noise is to be measured. These standards are intended to protect persons from excessive noise levels, which are detrimental to the public health, welfare, and safety and contrary to the public interest. It is the intent of this chapter to protect persons from excessive levels of noise within or near various residential development and other specified noise-sensitive land uses.

Section 23.06.042 (Exceptions to Noise Standards). The standards of CZLUO Sections 23.06.044 through 23.06.050 are not applicable to noise from the following sources:

(2) The use of any mechanical device, apparatus or equipment related to or connected with emergency activities or emergency work to protect life or property;

(4) Noise sources associated with construction, provided such activities do not take place before 7:00 a.m. or after 9:00 p.m. any day except Saturday or Sunday, or before 8:00 a.m. or after 5:00 p.m. on Saturday or Sunday; and

(8) Noise sources associated with work performed by private or public utilities in the maintenance or modification of its facilities.

Section 23.06.044 (Exterior Noise Level Standards). The exterior noise level standards of this section are applicable when a land use affected by noise is one of the following noise-sensitive uses which are defined in the land use element and local coastal plan: residential uses listed in Table O, framework for planning, except for residential accessory uses and temporary dwellings; health care services (hospitals and similar establishments only); hotels and motels; bed and breakfast facilities; schools (preschool to secondary, college and university, specialized education and training); churches; libraries and museums; public assembly and entertainment; offices, and outdoor sports and recreation.

(1) No person shall create any noise or allow the creation of any noise at any location within the unincorporated areas of the county on property owned, leased, occupied or otherwise controlled by such person which causes the exterior noise level when measured at any of the preceding noise-sensitive land uses situated in either the incorporated or unincorporated areas to exceed the noise level standards in the following table. When the receiving noise-sensitive land use is outdoor sports and recreation, the following noise level standards shall be increased by ten dB.

Exterior Noise Level Standards

Noise Standard	Daytime (7 a.m. to 10 p.m.)	Nighttime[1] (10 p.m. to 7 a.m.)
Hourly equivalent sound level (Leq, dB) 50 45	50	45
Maximum level, dB 70 65	70	65
Notes: 1. Applies only to uses that operate or are occupied during nighttime hours.		

(2) In the event the measured ambient noise level exceeds the applicable exterior noise level standard in subsection (1), the applicable standard shall be adjusted so as to equal the ambient noise level plus one dB.

(3) Each of the exterior noise level standards specified in subsection (1) shall be reduced by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.

(4) If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the exterior noise level standards.

Section 23.06.060 (Vibration Standards). Any land use conducted in or within one-half mile of an urban or village reserve line is to be operated to not produce detrimental earth-borne vibrations perceptible at the points of determination identified in the following table:

CZLUO Vibration Standards

Land Use Category in Which Vibration Source is Located	Point of Determination
Residential, office and professional, recreation, commercial	At or beyond any lot line of the lot containing the use
Industrial	At or beyond the boundary of the industrial category

Section 23.06.062 (Exceptions to Standards). The vibration standards of this chapter are not applicable to:

(1) Vibrations from construction, the demolition of structures, surface mining activities or geological exploration between 7:00 a.m. and 9:00 p.m.;

(2) Vibrations from moving sources such as trucks and railroads.

7.4 SAN LUIS OBISPO COUNTY BUILDING AND CONSTRUCTION ORDINANCE

GEOLOGY AND SOILS

In California, construction regulations consist of the California Building Code (CBC) and any additions or modifications to the CBC implemented by the local government. The San Luis Obispo County Building and Construction Ordinance (Title 19 of the San Luis Obispo County Code) (BCO) was established and adopted to protect and promote the public health, safety, and welfare. This ordinance is intended to regulate the design and construction of buildings and structures through basic standards for site preparation, erosion and sedimentation control, construction activities, quality of materials, occupancy classifications, the location and maintenance of buildings and structures and certain equipment associated with buildings and structures. According to BCO Chapter 19.3, *Building Code*, the 2010 CBC was adopted, as modified, amended, and/or supplemented.

HYDROLOGY AND WATER QUALITY

Refer to the BCO above.

7.5 SAN LUIS OBISPO AIR POLLUTION CONTROL DISTRICT STANDARDS

AIR QUALITY

Rule 202 - Permits

A. General

1. Authority to Construct: Any person building, erecting, altering or replacing any article, machine, equipment or other contrivance, the use of which may cause the issuance of air contaminants or the use of which may eliminate or reduce or control the issuance of air contaminants, shall first obtain authorization for such construction from the Air Pollution Control Officer.

2. Permits to Operate: Before any article, machine, equipment or other contrivance, the use of which may cause, increase, eliminate, reduce or control the issuance of air contaminants may be operated or used, a Permit to Operate shall be obtained from the Control Officer, except as provided in subsection A.5.

Rule 401 – Visible Emissions

A. A person shall not discharge into the atmosphere from any single source of emission whatsoever any air contaminant for a period or periods aggregating more than three minutes in any hour which is:

1. As dark or darker in shade as that designated as No. 1 on the Ringlemann Chart, as published by the United States Bureau of Mines.

2. Of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in Subsection A.1 of this Rule.

Rule 402 - Nuisance

A. A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property.

Rule 431 - Stationary Internal Combustion Engines

D. Exemptions: With the exception of recordkeeping and reporting requirements necessary to justify an exemption, the provisions of this Rule shall not apply to the operation of stationary internal combustion engines used under the following conditions: 3) Emergency standby engines operated during either an emergency or maintenance operation. Maintenance operation is limited to 100 hours per calendar year.

G. Recordkeeping: The operator of any engine subject to the provisions of Section D of this Rule shall maintain an inspection log that includes, on a monthly basis the following data:

   a. Date and results of each engine inspection;
   b. A summary of any preventive or corrective maintenance taken;
   c. The total hours of operation;
   d. The type and quantity of fuel used; and
   e. Any additional information required in the Engine Operator Inspection Plan.

   The operator shall maintain the inspection log for a period of three (3) years after the date of each entry. The log shall be available for inspection by the District upon request.

7.6 PROJECT MITIGATION MEASURES

AESTHETICS

AES-1 Prior to Grading Permit issuance, the CCSD shall confirm that the plans and specifications stipulate that, Project construction shall implement standard practices to minimize potential adverse impacts to the site's visual character, including the following:

- Construction staging areas shall be located as far as practicable from sensitive receptors; and
- Construction areas shall receive appropriate routine maintenance to minimize unnecessary debris piles.

AES-2 Prior to Grading Permit issuance: areas of the site where native vegetation has been removed and where water facilities are not proposed, shall be revegetated with indigenous plants; and vegetation comprised of indigenous plants shall be provided along the Project site's western boundary to screen the proposed water facilities from San Simeon Creek Campground view (northeastern most camp sites 18, 19, 21, 23, and 24). Prior to revegetation and new vegetation, a Landscape Plan (for the areas of revegetation and along the site's western boundary) shall be prepared for review and approval by the County.

AIR QUALITY

AQ-1 General Air Quality. The following measures shall be incorporated into the construction phase of the Project and shown on all applicable plans:

- Maintain all construction equipment in proper tune according to manufacturer's specifications;
- Fuel all off-road and portable diesel powered equipment, including but not limited to bulldozers, graders, cranes, loaders, scrapers, backhoes, generator sets, compressors, auxiliary power units, with ARB certified motor vehicle diesel fuel (non-taxed version suitable for use off-road); and
- Maximize to the extent feasible, the use of diesel construction equipment meeting the CARB's 1996 or newer certification standard for off-road heavy-duty diesel engines.

Fugitive PM_{10} Mitigation Measures

All required PM_{10} measures shall be shown on applicable grading or construction plans. In addition, the developer shall designate personnel to insure compliance and monitor the effectiveness of the required dust control measures (as conditions dictate, monitor duties may be necessary on weekends and holidays to insure compliance); the name and telephone number of the designated monitor(s) shall be provided to the SLOAPCD prior to construction/ grading permit issuance

- Reduce the amount of the disturbed area where possible;
- Use of water trucks or sprinkler systems in sufficient quantities to prevent airborne dust from leaving the site. Increased watering frequency would be required whenever wind speeds exceed 15 mph. Reclaimed (nonpotable) water should be used whenever possible;
- All dirt stock-pile areas should be sprayed daily as needed;
- Permanent dust control measures identified in the approved Project revegetation and landscape plans should be implemented as soon as possible following completion of any soil disturbing activities;
- Vehicle speed for all construction vehicles shall not exceed 15 mph on any unpaved surface at the construction site;
- All trucks hauling dirt, sand, soil, or other loose materials are to be covered or should maintain at least two feet of freeboard (minimum vertical distance between top of load and top of trailer) in accordance with CVC Section 23114;
- Install wheel washers where vehicles enter and exit unpaved roads onto streets, or wash off trucks and equipment leaving the site; and
- Sweep streets at the end of each day if visible soil material is carried onto adjacent paved roads. Water sweepers with reclaimed water should be used where feasible.

BIOLOGICAL RESOURCES

BIO-1 All work areas shall be visibly flagged or staked prior to construction. Construction activities shall be limited to these approved work areas except with prior authorization from regulatory agencies.

BIO-2 A Worker Environmental Awareness Program (WEAP) shall be implemented to educate all construction personnel of the area's environmental concerns and conditions and relevant environmental protection measures. The WEAP will include environmental concerns and appropriate work practices, including spill prevention, emergency response measures, protection of sensitive resources, and proper implementation of BMPs, to all construction and maintenance personnel. All new workers that arrive after construction has started shall be trained under the WEAP within two days' time.

BIO-3 A qualified biologist or botanist shall conduct a preconstruction clearance survey for special-status plant species within the Project site. If present, any special-status plants shall be clearly flagged for avoidance with a suitable buffer zone during construction. If avoidance is not possible, the Project applicant will discuss potential relocation strategies with applicable regulatory agencies.

BIO-4 Prior to construction, all heavy equipment that will be left onsite in laydown yards shall be washed offsite and cleaned of all potential non-native weed seeds. Worker trucks shall be washed daily if they will be driven offroad or shall otherwise be left parked in laydown yards or on existing roads during construction.

BIO-5 All excavated material shall be removed from the Project site and disposed of properly or reused elsewhere. If left onsite, the material shall be moved into an area where it will not wash or erode into any riparian areas and shall be suitably covered or watered to reduce the potential for dust during high winds or rain events.

BIO-6 The Project applicant shall develop and implement an adaptive management program (AMP) for post construction operations. This plan shall be incorporated indefinitely until the Project facilities are no longer in use or until deemed no longer necessary by applicable regulatory agencies. The AMP is intended to monitor and protect the lagoon and riparian habitats adjacent to the Project site and, by extension, protect the species that inhabit it. The primary goal of the AMP would be to monitor the response of the lagoon and riparian habitats to the Project and, based on any noted adverse changes in these habitats, to adjust operations so that the amount of treated water that is injected or discharged back into the system, is either increased or decreased to restore affected habitat features. This may require a combination of any of the following:

- Monthly stream surveys during the period that the Project is actively drawing groundwater (currently expected to be May through October). The surveys would document the upstream extent of inundation in each water body, as well as water depth at predetermined locations to measure changes in water levels;
- Surveys for tidewater goby, steelhead, CRLF, western pond turtle, and/or two-striped garter snake to measure population levels over time; and
- Monitoring of riparian vegetation in the water bodies and in their upland extents.

BIO-7 The Project applicant shall delay the annual period of groundwater pumping to the greatest extent possible, preferably after June, in order to maximize the amount of time for steelhead to migrate up and down San Simeon Creek.

BIO-8 Preconstruction diurnal and nocturnal surveys shall be conducted for CRLF in the percolation ponds and surrounding area within 48 hours of the start of construction. Any CRLF detected during surveys shall be relocated to areas outside of the construction zone, i.e. to San Simeon Creek, San Simeon Creek Lagoon, or Van Gordon Creek. Exclusion fencing shall be placed around work areas to avoid or minimize the risk of CRLF migrating into work areas during upland movements. The biologist conducting the surveys and performing any relocations shall hold a valid 10(a)(1)(A) recovery permit and Scientific Collecting Permit allowing take of CRLF.

BIO-9 All Project-related trash, food or otherwise, shall be disposed of after use in appropriate secured containers. These containers shall be emptied offsite regularly.

BIO-10 No more than one week prior to construction, a qualified biologist shall conduct a preconstruction nesting bird clearance survey in all work areas and all areas within 500 feet of the general construction zone. Active nests shall be given an avoidance buffer, typically 300 feet for non-listed, non-raptor species, and 500 feet for listed or raptor species. This buffer shall remain in place until the young fledge or the nest otherwise becomes inactive, and may be reduced with approval from CDFW and/or USFWS.

BIO-11 If deemed necessary by the CDFW, a preconstruction roosting bat survey shall be conducted within one week prior to construction. Any bat roosts found in the Project vicinity shall be protected with coordination from CDFW.

BIO-12 All construction shall occur between dawn and dusk.

BIO-13 In areas adjacent to riparian habitat, construction noise shall be minimized to the amount necessary to avoid or reduce the risk of adverse impacts to wildlife.

BIO-14 In areas within 100 feet of riparian habitat, BMPs shall be implemented. These should include, but are not limited to, sedimentation control, erosion control, spill prevention and cleanup, and hazardous materials.

BIO-15 The Project Applicant shall consult with the Corps, CDFW, and Regional Board regarding potential impacts and required mitigation once the final Project design is available. If impacts are anticipated to occur to instream and riparian habitats, wetland permits may be required from these agencies.

CULTURAL RESOURCES

CUL-1 Prior to the start of construction, earthmoving personnel shall receive a cultural and paleontological sensitivity training detailing the types of artifacts and fossils that may be encountered and procedures to follow if finds occur.

CUL-2 The Applicant shall retain qualified archaeological monitor and Native American monitor, approved by the County Environmental Coordinator, to be present during all site disturbance activities within the boundaries of previously recorded sites. Monitoring reports shall be retained by the Applicant and shared with the Environmental Coordinator's Office upon request.

NOISE

NOI-1 Prior to Grading Permit issuance, the Project applicant shall demonstrate, to the satisfaction of the County of San Luis Obispo Planning and Building Manager that the Project complies with the following:

- Construction contracts specify that all construction equipment, fixed or mobile, shall be equipped with properly operating and maintained mufflers and other state required noise attenuation devices.
- During construction, stationary construction equipment shall be placed such that emitted noise is directed away from sensitive noise receivers.
- Construction equipment staging areas shall be located away from adjacent sensitive receptors.

- Construction activities shall not take place outside of the allowable hours specified by the County's Municipal Code Section 23.06.042, (7:00 a.m. to 9:00 p.m. any day except Saturday or Sunday, or 8:00 a.m. to 5:00 p.m. on Saturday or Sunday).

8.0 CONSULTANT RECOMMENDATION

Based on the information and environmental analysis contained in the Initial Study/Environmental Checklist, it is recommended that the Cambria Community Services District prepare a Mitigated Negative Declaration for the Cambria Emergency Water Supply Project. We find that the Project could have a significant effect on a number of environmental issues, but that mitigation measures have been identified that reduce such impacts to less than significant. It is recommended that the second category be selected for the CCSD's determination; refer to Section 9.0, *Lead Agency Determination*.

June 20, 2014
Date

Rita Garcia
Project Manager
Planning/Environmental Services
RBF Consulting

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9.0 LEAD AGENCY DETERMINATION

On the basis of this initial evaluation:

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

I find that although the proposal could have a significant effect on the environment, there will not be a significant effect in this case because the mitigation measures described in Section 4.0 have been added. A MITIGATED NEGATIVE DECLARATION will be prepared. [X]

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

I find that the proposal MAY have a significant effect(s) 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, if the effect is a "potentially significant impact" or "potentially significant unless mitigated." An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed. [ ]

Signature	Cambria Community Services Department Agency
Mr. Jerry Gruber, General Manager Printed Name/Title	June 20, 2014 Date

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APPENDIX 3-3F – CCSD RATE STUDY

Cambria Community Services District

Water Rate Study

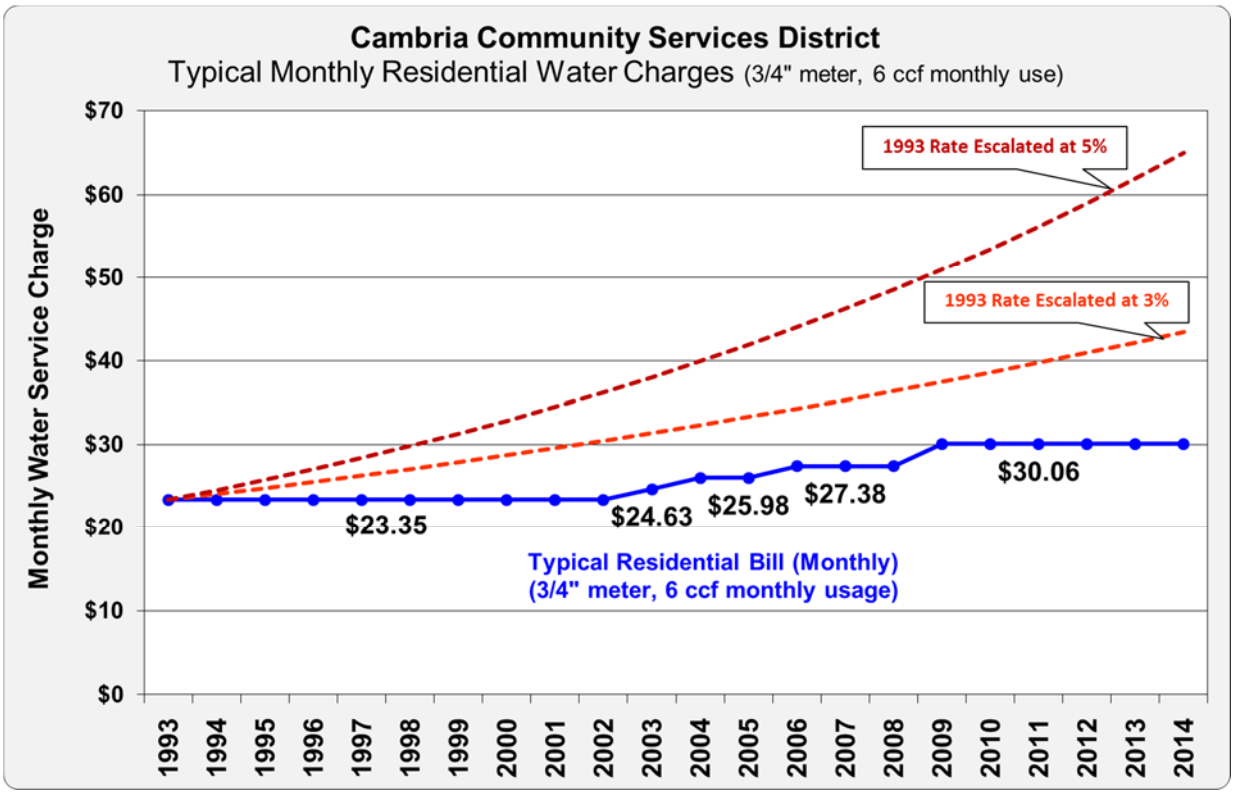
Draft 5/28/14

BARTLE WELLS ASSOCIATES
INDEPENDENT PUBLIC FINANCE ADVISORS

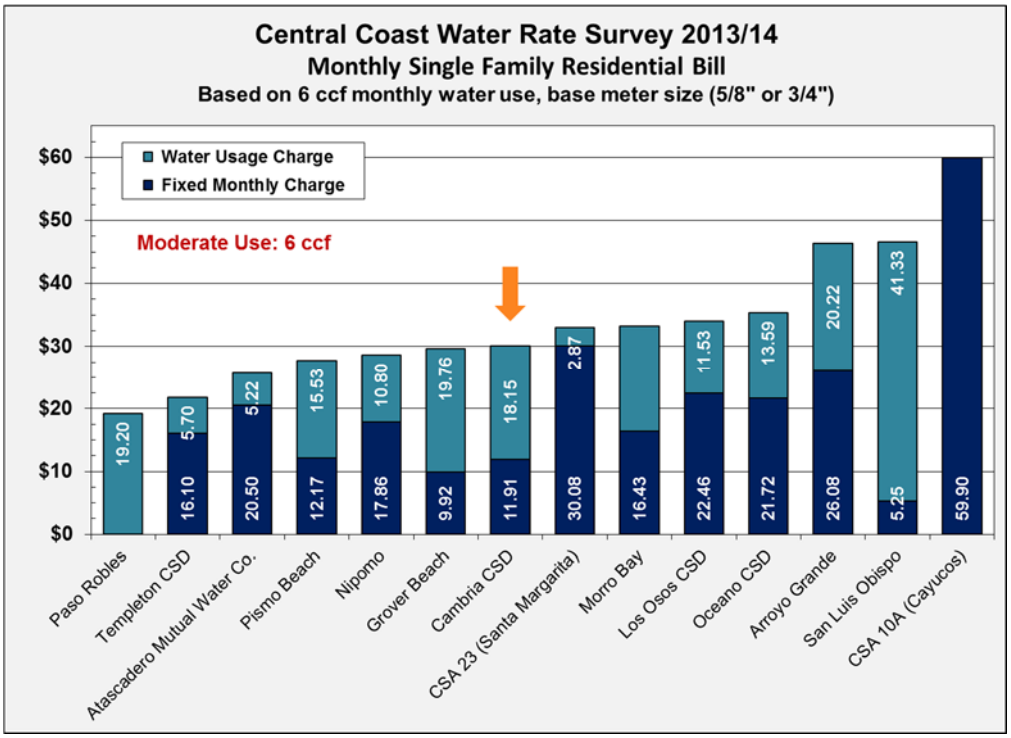
Cambria Community Services District
Water Rate Study
Summary of Key Issues

Water Rates & Finances

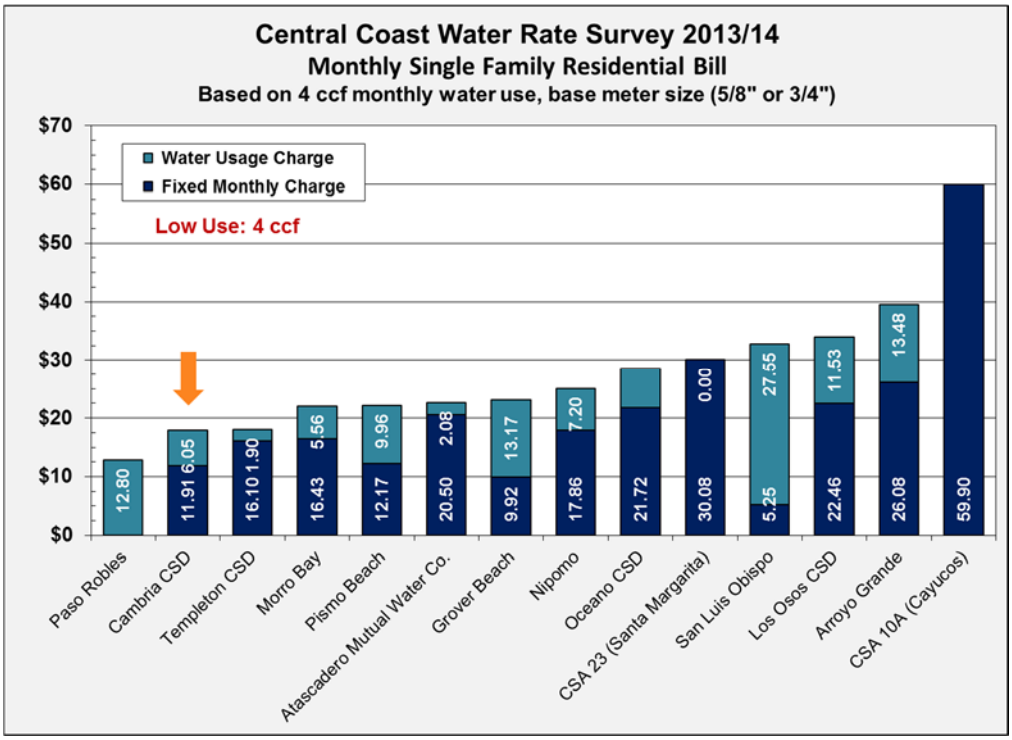
- Water utility is supposed to be a self-supporting enterprise fund
  - Rates are the main source of revenue & account for 85-90% of total revenues
  - Revenues must be adequate to fund the cost of providing service including long-term operating and capital needs and emergency water supply
- CCSD has adopted minimal rate increases over the past 20 years
  - Water utility has been starved of funding
  - Water rates have been subsidized by CCSD's use of the General Fund to cover deficits
  - No rate increases were implemented in 15 of the past 20 years
  - Since 1993, water rates have risen by an average of 1.2% per year
  - The monthly charge for a home using 6 hcf of water per month has increased by $6.71 over the past 20 years, from $23.35 to $30.06 per month
  - Roughly 3/4^{ths} of single family residential bills are at or below this level of use
  - Since 1993, CPI has increased approximately 66%
  - Adjusted for inflation, water rates today are *more than 20% lower* than they were in 1993
- Water rates were last increased effective 2009
  - Over 5 years have gone by with no rate increases despite increasing funding requirements and need for a supplemental water supply project



- Water rates are moderate to low compared to other regional agencies
  - Monthly Bill for a typical single family home with use of 6 hcf of monthly water = $30.06
  - Equivalent to $0.67 per each 100 gallons of water use (2/3rds of a penny per gallon)
  - This falls in the middle range compared to other regional agencies



- Bills are very low for low-use customers (including 2nd homes) due to CCSD's rate structure
  - Monthly Bill for a lower-use home with 4 hcf of monthly water = $17.96
  - Equivalent to $0.60 per each 100 gallons of water use (6/10ths of a penny per gallon)



- Water enterprise has been operating in deficit mode
- Although CCSD has made some capital repairs and improvements in recent years, many high-priority projects have been deferred due to inadequate funding available
  - Many aging facilities are at the end of their useful life and will need to be rehabilitated or replaced in upcoming years; CCSD has more than maximized the useful life of many assets
- ***CCSD is facing substantial financial challenges that will require substantial rate increases***
  - Rate increases should not be a political decision, they are a financial necessity to fund the cost of providing service

Financial Challenges & Drivers of Rate Increases

- **Restore Balanced Budgets & Fund Ongoing Operations**
  - Operating costs have risen over the years without a corresponding increase in rates
  - Water enterprise has been operating in deficit mode and has relied on subsidies from CCSD's General Fund to cover annual budget deficits
  - Current rates generate no annual funding for ongoing repairs and replacements that are needed to maintain the water system and are an inherent cost of providing service
  - Rate increases needed to restore financial stability and provide at least a minimal prudent level of funding for ongoing re-investment in the water system
    - *Based on input from CCSD, BWA recommends phasing in funding to $250,000 per year for ongoing repairs, replacements, and system rehabilitation*

- **Critical Water System Capital Improvements**
  - CCSD is facing $2,440,000 of high-priority, immediate capital projects
    - *Rodeo Grounds Pump Station Replacement: $1,025,000*
    - *Fiscalini Tank Replacement: $640,000*
    - *Stuart Street Tank: $775,000*
  - Debt financing needed due to lack fund reserves and inadequate rates (otherwise it would be many years until CCSD accumulated adequate cash to fund projects on a pay-as-you-go basis)
    - *Annual debt service for funding projects equals roughly $225,000 per year (assuming 15-year term and 4% average annual interest rate)*
    - *This level of debt service can be largely offset by the end of the water enterprise's 65% share of repayment for the 2006 Bank Loan, which reaches final maturity in the upcoming fiscal year and will free up about $180,000 per year that could be used toward new debt*
  - Revenue increases needed to fund incremental increase in debt service for critical projects

- **Reduced Water Sales Put Substantial Upward Pressure on Rates**
  - CCSD has declared a Level 3 Water Emergency due to drought and potential for running out of potable water supply
  - Water sales have decreased due to customer response to drought & emergency rate surcharges
    - *Water use and water quantity charge revenues from the March/April billing period decreased approximately 40% from the prior 2-year historical average*
    - *Residential use decreased by about 50% with lesser cutback from commercial accounts*
  - Revenues from the emergency drought rate surcharges substantially offset the revenue loss from reduced water sales for the March/April billing period
    - *CCSD Board subsequently reduced the emergency drought rate surcharges*

    - *CCSD vulnerable to additional revenue shortfalls due to large cutbacks in use coupled with reduced drought rate surcharge revenues*
- In general, emergency drought rates should be phased out as water use returns to "normal"
- Difficult to predict future annual water sales
    - *Based on substantial cutback in use during March/April billing period, it is very possible that water sales will not return to prior "normal year" levels*
    - *Note: Any rate increases implemented to compensate for reduced water sales will not affect customers who conserve since they will be purchasing fewer units of water*

➢ **Emergency Water Supply: $7.0 - $8.8 million capital costs**

- CCSD is 100% reliant on groundwater pumped from wells drilled into the aquifers of the San Simeon and Santa Rosa creek basins
- Drought has critically reduced flows in each creek resulting in minimal groundwater recharge, declining groundwater levels, and increased potential for seawater intrusion into the aquifers
    - *Water supply at risk of running dry*
    - *CCSD facing risk of degradation and potential permanent damage to aquifers*
    - *Emergency Water Supply needed to address immediate and long-term water supply needs*
- Latest engineering cost estimates for Emergency Water Supply project: $7.0 to $8.8 million
    - *Original cost estimate was over $15 million, but CCSD staff have successfully worked with CDM Smith to reduce project scope and cost*
    - *Estimates include soft costs (planning, design, permitting, etc.) and purchase of equipment*
    - *Emergency Water Supply project will likely need to be debt financed*
    - *Rates adequate to secure debt repayment must be adopted before financing can be obtained*
    - *Rates securing debt must be reliable*
- Annual debt service may vary based on repayment term and other factors
    - *Debt service projected at roughly $700,000 to $800,000 per year*
- Operating costs estimated at $380,000 assuming 6 months of operations and roughly 250 Acre-Feet (AF) of water supply
    - *$380,000 / 250 AF = $1,520 per AF or about $3.50 per hcf of water*
    - *Actual facility use will vary based on need; CCSD may only need to operate the facility for 3 months per year for example*
    - *Operating costs can be recovered by a temporary surcharge when facility is in operation*
    - *Some ongoing costs needed to maintain facility regardless of use*

Financial Projections

➢ BWA developed 10-year financial projections to evaluate annual revenue requirements and project rate increases

➢ Key Assumptions:

- Based on 2013/14 Budget
- Operating costs escalate at 4% per year
- Assumes no growth in customer base
- Water sales projected at 80% of historical "normal year" usage; *assumes 20% permanent cutback in water use due to lasting effects of drought response and price elasticity*
- Assumes $8.8 million cost for Emergency Water Supply project

- Assumes CCSD issued debt to fund a) $8.8 million Water Supply Project (including payback of $2.1 million of loans from the General Fund) and b) $2.4 million funding for highest-priority immediate capital needs
- Funding level for ongoing repairs, replacements, and rehabilitation phased in to $250,000 per year plus future 4% cost inflation
- Assumes separate charges will be adopted to fund a) ongoing water services and system capital needs, and b) costs of the Emergency Water Supply project and operations
- Rate increases phased in over 3 years to the extent possible

Current Water Rate Structure

- Water rates include 2 components:
  - Fixed meter charge (base rate), includes first 6 units of bi-monthly water at no add'l cost
  - Quantity charges (applies to metered use over 6 units; billed via 9 rate tiers)

Current Water Rates (Bi-Monthly) *Effective 7-1-2009*

		Residential	Commercial
Base Rate *Includes first 6 ccf of water*		$23.82	$54.07
Quantity Charges			
Tier	Use (ccf)		
Tier 1	6 - 15	$6.05	$6.69
Tier 2	16 - 20	6.18	6.83
Tier 3	21 - 30	6.30	6.95
Tier 4	31 - 40	6.44	7.08
Tier 5	41 - 50	6.95	7.47
Tier 6	51 - 60	7.22	7.73
Tier 7	61 - 70	7.47	8.12
Tier 8	71 - 80	7.73	8.37
Tier 9	81+	7.86	9.02

Note: 1 ccf = 100 cubic feet = 748 gallons

- Issues with current rate structure
  - Slightly over 50% of residential water and about 15% of commercial water is not billed, but is instead included with 6 units water allowance
  - Almost all the rest of residential use is billed in Tiers 1-3 (90% through Tier 2,)
  - Residential tiers not set in any meaningful way based on water usage patterns; however commercial use is spread through the tiers
  - Minimal difference between rates for each tier (similar to a uniform rate for all use)
  - Commercial water quantity charges are roughly 10% higher than residential rates
  - Average weighted rate per unit of water purchased is substantially higher for commercial than residential customers due to high percentage of residential water not billed and substantially more commercial use in higher tiers at higher rates
  - Commercial fixed charge applies to all businesses (big and small) & does not vary by meter

Proposition 218 Rate Requirements *(California Constitution Article 13D, Section 6)*

- Rates cannot exceed the cost of providing service
- Revenues can only be used for the purpose for which they are collected
- Charges cannot exceed the *proportional cost of service* attributable to the parcel
- Fees may only be imposed if service is used by or immediately available to the property charged

Rate Calculation Process

- Determine annual revenue requirements from rates based on financial projections
- Allocate costs for recovery via a) fixed meter charges or b) water quantity charges
- Fixed charges: Cost recovery from fixed charges are proportionally recovered from each account based on the estimated demand placed on the water system by each account
- Variable charges: Cost recovery from water quantity charges assume a consistent rate structure for all customers, and are designed to recover costs allocated to variable rates assuming 20% permanent conservation compared to historical "normal year" water use

Water Rate Structure Conceptual Alternatives

- **Fixed meter charges:** base charge levied on each account regardless of water use for the purpose of funding a portion of CCSD's fixed costs of providing service
  - Single family residential: maintain uniform fixed charge for all accounts
  - Commercial/multi-family: transition to fixed charges based on meter size and capacity
- **Proposed Fixed Bi-Monthly Meter Charges**

		Current	Proposed		
		Charges	2014/15	2015/16	2016/17
Residential					
Per Dwelling Unit		$23.82	$24.00	$25.00	$26.00
Commercial					
Meter Size	Capacity Ratio[1]				
5/8" or 3/4"	2.000	$54.07	$48.00	$50.00	$52.00
1"	3.333	54.07	80.00	83.33	86.67
1-1/2"	6.667	54.07	160.00	166.67	173.33
2" & Larger	10.667	54.07	256.00	266.67	277.33

1 Based on analysis of water billing data and standard AWWA meter capacities.

Water quantity charges: Rate per unit of metered water use

- BWA developed and evaluated a number of conceptual rate structure approaches
  A. Uniform rate for all water use
  B. Simplified inclining tier rates with same rate structure for all accounts
  C. Gradually escalating rates for all accounts
- Emergency Water Supply charges are assumed to be separate charges from regular water rates

- **Conceptual Rate Alternative A: Uniform Rate for All Water Use**

	2014/15	2015/16	2016/17
WATER QUANTITY CHARGES ($/ccf)			
Rate for All Water Use	$6.00	$7.25	$8.50
Equivalent Rate per 100 Gallons	*$0.80*	*$0.97*	*$1.14*

- **Conceptual Rate Alternative B: 3-Tiered Rate Structure**

			2014/15	2015/16	2016/17
WATER QUANTITY CHARGES ($/ccf)					
Water Quantity Tiers		% Use in Tier			
Tier 1	1 - 4 ccf	32%	$3.00	$3.63	$4.25
Tier 2	5 - 16 ccf	38%	6.00	7.25	8.50
Tier 3	>16 ccf	30%	9.00	10.88	12.75

- **Conceptual Rate Alternative C: Escalating Rates**

		2014/15	2015/16	2016/17
WATER QUANTITY CHARGES ($/ccf)				
Water Use (ccf)	% of Use			
1	8.0%	$1.00	$1.20	$1.40
2	7.5%	2.00	2.40	2.80
3	7.0%	3.00	3.60	4.20
4	6.5%	4.00	4.80	5.60
5	6.0%	5.00	6.00	7.00
6	5.5%	6.00	7.20	8.40
7	5.0%	7.00	8.40	9.80
8+	54.5%	8.00	9.60	11.20

Projected Monthly Rate Impacts

	Bi-Monthly Use (ccf)	% of Bills at or Below	With 20% Conservation	Current Monthly Bill	Monthly Bill with 20% Conservation								
					2014/15			2015/16			2016/17		
Single Family Residential Rate Impacts				Without Conservation	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C
Low Use	4	25%	3	$11.91	$21.00	$16.50	$15.00	$23.38	$17.95	$16.10	$25.75	$19.38	$17.20
Median Use	8	50%	6	17.96	30.00	24.00	22.50	34.25	27.01	25.10	38.50	30.00	27.70
Average Use	10	65%	8	24.01	36.00	30.00	30.00	41.50	34.26	34.10	47.00	38.50	38.20
Mod-High Use	12	75%	10	30.06	42.00	36.00	38.00	48.75	41.51	43.70	55.50	47.00	49.40
High Use	20	90%	16	54.59	59.99	54.00	62.00	70.50	63.26	72.50	81.00	72.50	83.00
Sample Commercial & Multi-Family Residential Rate Impacts													
Meter Size 5/8" or 3/4"													
Low Use	8		6	$33.73	$42.00	$36.00	$34.50	$46.75	$39.51	$34.50	$51.50	$43.00	$40.70
Moderate Use	15		12	57.14	59.99	54.00	58.00	68.50	61.26	58.00	77.00	68.50	73.60
Mod-High Use	25		20	91.59	83.99	84.00	90.00	97.50	97.52	90.00	111.00	111.00	118.40
Meter Size 2"													
Low Use	50		40	202.64	$247.98	$278.00	$274.00	$278.34	$314.66	$308.54	$308.67	$351.17	$343.07
Moderate Use	100		80	386.52	367.96	458.00	434.00	423.34	532.26	500.54	478.67	606.17	567.07
Mod-High Use	200		160	805.02	607.93	818.00	754.00	713.34	967.46	884.54	818.67	1,116.17	1,015.07

Emergency Water Supply (EWS) Charges

- Separate charges to recover costs for the Emergency Water Supply project and operations
- **Capital cost recovery** assumes debt financing for an $8.8 million project (latest engineering cost estimates) with a) no grant funding and b) full repayment of approximately $1.9 million in loans from CCSD's General Fund.
  - Charges can be adjusted in the future to account for any grant funding, General Fund contributions, or changes in water sales
- **Operating cost recovery** assumes $50,000 per year needed for minimal maintenance needed to keep facility in operating condition ready for use, plus operating and maintenance costs per unit during actual operation (based on latest engineering cost estimates)

EWS Capital Cost Recovery

- **Fixed Meter Charges**: base charge levied on each account regardless of water use
  - Designed to recover 35% of a) debt service used to finance capital costs with 20% contingency for unknowns, and b) an estimated $50,000 per year for minimum facility maintenance costs to ensure the facility remains in operating condition for when needed
- **Water Quantity Charges**: charged on metered water use to recover a substantial portion of costs based on actual water use and demand placed on the system by each customer
  - Designed to recover 65% of a) debt service used to finance capital costs with 20% contingency for unknowns, and b) an estimated $50,000 per year for minimum facility maintenance costs to ensure the facility remains in operating condition for when needed

EWS Operating Cost Recovery

- Designed to recover operating costs when facility is in operation
- Billed only during periods of anticipated facility operation (e.g. July – Oct)

Emergency Water Supply Surcharges			
		Capital Cost Recovery	**Operating Cost Recovery**
		Billed Throughout Year	Billed During Periods of Planned Use
Fixed Bi-Monthly Meter Charges			
Residential *Charge per Dwelling Unit*		$13.00	*No Fixed Charges for O&M*
Commercial			
Meter Size	Capacity Ratio[1]		
5/8" or 3/4"	2.00	$26.00	*No Fixed Charges for O&M*
1"	3.33	43.33	
1-1/2"	6.67	86.67	
2" or larger	10.67	138.67	
Water Quantity Charges			
Alternative A: Uniform Rate on All Use			
Charge per ccf for all water use		$2.95	$3.10
Alternative B: 3-Tiered Rate Structure (Reduced Impact on Low Use)			
Water Use Tier	Use in Tier		
Tier 1	1 - 4 ccf	$1.50	$1.50
Tier 2	5 - 16 ccf	3.00	$3.00
Tier 3	>16 ccf	4.50	$5.00
Alternative C: Escalating Rates			
Water Use (ccf)			
1		$1.00	$0.75
2		1.40	1.25
3		1.80	1.75
4		2.20	2.25
5		2.60	2.75
6		3.00	3.25
7		3.40	3.75
8+		3.90	4.25
1 Based on analysis of water billing data and standard AWWA meter capacities.			

Projected Monthly Emergency Water Supply Surcharge Impacts

	% of Bills at or Below	Bi-Monthly Use 20% Conservation	Monthly Charges *Billed Througout Year*			Plus O&M Surcharges *During Periods of Operation*		
Single Family Residential Rate Impacts			**Alt A**	**Alt B**	**Alt C**	**Alt A**	**Alt B**	**Alt C**
Low Use	25%	3	**$10.93**	**$8.75**	**$8.60**	**$4.65**	**$2.25**	**$1.88**
Median Use	50%	6	**15.35**	**12.50**	**12.50**	**9.30**	**6.00**	**6.00**
Average Use	65%	8	**18.30**	**15.50**	**16.15**	**12.40**	**9.00**	**10.00**
Mod-High Use	75%	10	**21.25**	**18.50**	**20.05**	**15.50**	**12.00**	**14.25**
High Use	90%	16	**30.10**	**27.50**	**31.75**	**24.80**	**21.00**	**27.00**
Sample Commercial & Multi-Family Residential Rate Impacts								
Meter Size 5/8" or 3/4"								
Low Use		6	**$21.85**	**$17.50**	**$19.00**	**$9.30**	**$6.00**	**$6.00**
Moderate Use		12	**30.70**	**26.50**	**30.45**	**18.60**	**15.00**	**18.50**
Mod-High Use		20	**42.50**	**41.50**	**46.05**	**31.00**	**31.00**	**35.50**
Meter Size 2"								
Low Use		40	**$128.33**	**$142.83**	**$141.38**	**$62.00**	**$81.00**	**$78.00**
Moderate Use		80	**187.33**	**232.83**	**219.38**	**124.00**	**181.00**	**163.00**
Mod-High Use		160	**305.33**	**412.83**	**375.38**	**248.00**	**381.00**	**333.00**

Total Combined Rate Impacts: Water Rates + Emergency Water Supply Surcharges

	Bi-Monthly Use (ccf)	% of Bills at or Below	With 20% Conservation	Current Monthly Bill	Monthly Bill + EWS Capital Surcharge (with 20% Conservation)									Plus EWS O&M		
					2014/15			2015/16			2016/17			*During Periods of Operation*		
Single Family Residential Rate Impacts				Without Conservation	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C
Low Use	4	25%	3	$11.91	$31.92	$25.25	$23.60	$34.30	$26.70	$24.70	$36.68	$28.13	$25.80	$4.65	$2.25	$1.88
Median Use	8	50%	6	17.96	45.35	36.50	35.00	49.60	39.51	37.60	53.85	42.50	40.20	9.30	6.00	6.00
Average Use	10	65%	8	24.01	54.30	45.50	46.15	59.80	49.76	50.25	65.30	54.00	54.35	12.40	9.00	10.00
Mod-High Use	12	75%	10	30.06	63.25	54.50	58.05	70.00	60.01	63.75	76.75	65.50	69.45	15.50	12.00	14.25
High Use	20	90%	16	54.59	90.09	81.50	93.75	100.60	90.76	104.25	111.10	100.00	114.75	24.80	21.00	27.00
Sample Commercial & Multi-Family Residential Rate Impacts																
Meter Size 5/8" or 3/4"																
Low Use	8		6	$33.73	$63.85	$53.50	$53.50	$68.60	$57.01	$53.50	$73.35	$60.50	$59.70	$9.30	$6.00	$6.00
Moderate Use	15		12	57.14	90.69	80.50	88.45	99.20	87.76	88.45	107.70	95.00	104.05	18.60	15.00	18.50
Mod-High Use	25		20	91.59	126.49	125.50	136.05	140.00	139.02	136.05	153.50	152.50	164.45	31.00	31.00	35.50
Meter Size 2"																
Low Use	50		40	$202.64	$376.31	$420.83	$415.38	$406.67	$457.49	$449.92	$437.00	$494.00	$484.45	$62.00	$81.00	$78.00
Moderate Use	100		80	386.52	555.30	690.83	653.38	610.67	765.09	719.92	666.00	839.00	786.45	124.00	181.00	163.00
Mod-High Use	200		160	805.02	913.26	1,230.83	1,129.38	1,018.67	1,380.29	1,259.92	1,124.00	1,529.00	1,390.45	248.00	381.00	333.00

Next Steps

- Receive additional input and finalize rates for Proposition 218 notices
- A majority of Board Members have indicated a preference for going through the Prop. 218 process for Emergency Water Supply Surcharges only, then subsequently going through the process again for regular water service charges
  - This would require subsequently going through the Prop. 218 process a second time for necessary increases for ongoing water service
  - BWA advises that it may be difficult to obtain financing for the Emergency Water Supply project without also adopting rate increases required to fund ongoing water system operations and high-priority capital needs; the District may need to wait until the regular rate increases are also adopted before it can secure project financing
- Draft and mail Proposition 218 notices
- Hold a public hearing on the proposed rates at least 45 days after mailing the Prop. 218 notices, public hearing is currently scheduled for July 24
- CCSD can implement rates lower than shown in the Prop. 218 notice, for example if the District receives partial grant funding for the Emergency Water Supply facility; however, the CCSD may not exceed the rates shown on the notice without going through the Proposition 218 process for any increases

---

Table 1
Cambria Community Services District
Current Water Rates

WATER RATES (Bi-Monthly)

Effective 7-1-2009

		Residential	Commercial
Base Rate *Includes first 6 ccf of water*		$23.82	$54.07
Quantity Charges			
Tier	Use (ccf)		
Tier 1	6 - 15	$6.05	$6.69
Tier 2	16 - 20	6.18	6.83
Tier 3	21 - 30	6.30	6.95
Tier 4	31 - 40	6.44	7.08
Tier 5	41 - 50	6.95	7.47
Tier 6	51 - 60	7.22	7.73
Tier 7	61 - 70	7.47	8.12
Tier 8	71 - 80	7.73	8.37
Tier 9	81+	7.86	9.02

Note: 1 ccf = 100 cubic feet = 748 gallons

Table 2 - Cambria Community Services District Water Financial Projections - Base Case Draft 5-27-14

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Base Normal Year Water Demand	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000	280,000
Projected Water Demand	245,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000
Change from Base Year	-13%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%	-20%
Cost Escalation	0%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Interest Earnings Rate	0.35%	0.35%	0.5%	1.0%	1.5%	2.0%	2.0%	2.0%	2.0%	2.0%
Emergency Supply Operations (months)		4	4	4	4	4	4	4	4	4
Emergency Water Supply (AF)		167	167	167	167	167	167	167	167	167
Emergency Supply Supply (hcf)		72,600	72,600	72,600	72,600	72,600	72,600	72,600	72,600	72,600
Emergency Supply Production Costs ($ per hcf)		$3.03	$3.15	$3.28	$3.41	$3.55	$3.69	$3.84	$3.99	$4.15
Begininning Water Fund Reserves	$394,000	$286,000	$292,000	$312,000	$446,000	$631,000	$816,000	$993,000	$1,159,000	$1,307,000
REVENUES										
Water Operations										
Water Rate Revenue Requirement	1,600,000	2,000,000	2,300,000	2,600,000	2,750,000	2,850,000	2,950,000	3,050,000	3,150,000	3,250,000
Drought Rate Surcharges	100,000	150,000	0	0	0	0	0	0	0	0
Standby Availability	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000
Interest Income	1,000	1,000	1,000	3,000	7,000	13,000	16,000	20,000	23,000	26,000
Other Water Dept Fees & Charges	70,000	71,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Admin/Remod/Wait List/Retrofit/Misc Revs	250,000	115,000	115,000	115,000	115,000	115,000	115,000	115,000	115,000	115,000
Subtotal	2,146,000	2,462,000	2,611,000	2,913,000	3,067,000	3,173,000	3,276,000	3,380,000	3,483,000	3,586,000
Emergency Water Supply										
Emergency Supply Capital Charges	0	782,000	782,000	782,000	782,000	782,000	782,000	782,000	782,000	782,000
Minimum Facility Maintenance Charges	0	50,000	52,000	54,000	56,000	58,000	60,000	62,000	64,000	67,000
Emergency Supply Operating Charges	0	220,000	229,000	238,000	248,000	258,000	268,000	279,000	290,000	301,000
Subtotal	0	1,052,000	1,063,000	1,074,000	1,086,000	1,098,000	1,110,000	1,123,000	1,136,000	1,150,000
Financing Proceeds										
Debt Proceeds for Emergency Water Supply	0	8,800,000	0	0	0	0	0	0	0	0
Debt Proceeds for Critical CIP Projects	0	2,450,000	0	0	0	0	0	0	0	0
Grant Proceeds	0	0	0	0	0	0	0	0	0	0
Loan from General Fund	2,100,000	0	0	0	0	0	0	0	0	0
Subtotal	2,100,000	11,250,000	0	0	0	0	0	0	0	0
Total Revenues	4,246,000	14,764,000	3,674,000	3,987,000	4,153,000	4,271,000	4,386,000	4,503,000	4,619,000	4,736,000
EXPENSES										
Water System Operations										
Salaries & Benefits	700,000	684,000	711,000	739,000	769,000	800,000	832,000	865,000	900,000	936,000
Maintenance	373,000	388,000	404,000	420,000	437,000	454,000	472,000	491,000	511,000	531,000
Services & Supplies	323,000	336,000	349,000	363,000	378,000	393,000	409,000	425,000	442,000	460,000
Professional Services	188,000	196,000	204,000	212,000	220,000	229,000	238,000	248,000	258,000	268,000
Allocated Overhead	511,000	531,000	552,000	574,000	597,000	621,000	646,000	672,000	699,000	727,000
Subtotal	2,095,000	2,135,000	2,220,000	2,308,000	2,401,000	2,497,000	2,597,000	2,701,000	2,810,000	2,922,000
Emergency Supply Operations										
Emergency Supply Maintenance (ongoing)	0	50,000	52,000	54,000	56,000	58,000	60,000	62,000	64,000	67,000
Emergency Supply O&M (when operating)	0	220,000	229,000	238,000	248,000	258,000	268,000	279,000	290,000	301,000
Subtotal	0	270,000	281,000	292,000	304,000	316,000	328,000	341,000	354,000	368,000
Subtotal Operating Expenses	2,095,000	2,405,000	2,501,000	2,600,000	2,705,000	2,813,000	2,925,000	3,042,000	3,164,000	3,290,000
Debt Service										
2006 Bank Loan, 65% Water	44,000	0	0	0	0	0	0	0	0	0
New Debt for Critical Capital Projects	0	221,000	221,000	221,000	221,000	221,000	221,000	221,000	221,000	221,000
New Debt for Emergency Water Supply Project	0	782,000	782,000	782,000	782,000	782,000	782,000	782,000	782,000	782,000
Subtotal	44,000	1,003,000	1,003,000	1,003,000	1,003,000	1,003,000	1,003,000	1,003,000	1,003,000	1,003,000
Capital & Non-Operating										
Emergency Water Supply Project	2,100,000	6,700,000	0	0	0	0	0	0	0	0
Critical Near-Term Capital Projects	0	2,450,000	0	0	0	0	0	0	0	0
Repay General Fund Loan	0	2,100,000	0	0	0	0	0	0	0	0
High Priority Capital Project Funding	0	100,000	150,000	250,000	260,000	270,000	281,000	292,000	304,000	316,000
Rebate & Retrofit Programs	115,000	0	0	0	0	0	0	0	0	0
Subtotal	2,215,000	11,350,000	150,000	250,000	260,000	270,000	281,000	292,000	304,000	316,000
Total Expenses	4,354,000	14,758,000	3,654,000	3,853,000	3,968,000	4,086,000	4,209,000	4,337,000	4,471,000	4,609,000
Revenues Less Expenses	(108,000)	6,000	20,000	134,000	185,000	185,000	177,000	166,000	148,000	127,000
Ending Fund Reserves	286,000	292,000	312,000	446,000	631,000	816,000	993,000	1,159,000	1,307,000	1,434,000
Fund Rsrv Target: 30% O&M + $500K Emergency CIP	1,629,000	1,722,000	1,750,000	1,780,000	1,812,000	1,844,000	1,878,000	1,913,000	1,949,000	1,987,000
Debt Service Coverage	1.16	1.11	1.17	1.38	1.44	1.45	1.46	1.46	1.45	1.44

Table 3
Cambria Community Services District
Water Capital Improvement Program

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Critical Near-Term Capital Needs										
Fiscallini Tank Replacement	640,000									640,000
Stuart Street Tank III	775,000									775,000
Rodeo Grounds Pump Station Repl	1,025,000									1,025,000
Subtotal	2,440,000									
Other High Priority Capital Needs	100,000	200,000	250,000	260,000	270,000	281,000	292,000	304,000	316,000	2,273,000
Total	2,540,000	200,000	250,000	260,000	270,000	281,000	292,000	304,000	316,000	4,713,000

Table 4
Cambria Community Services District
Historical Water Billings by Month

Billing Period For Usage in	1 Jul/Aug	2 Sep/Oct	3 Nov/Dec	4 Jan/Feb	5 Mar/Apr	6 May/Jun	Fiscal Year Total
2013/14						est	
Water Use (hcf)	63,113	47,345	38,827	36,576	24,917	35,000	245,778
Fixed Service Charges	102,896	102,793	102,784	102,907	102,886	103,000	617,266
Usage Charges	288,513	192,906	137,198	129,137	97,979	140,000	985,733
Drought Surcharges	-	-	-	-	70,707	30,000	100,707
Total	391,409	295,699	239,982	232,044	271,572	273,000	1,703,706
2012/13							
Water Use (hcf)	61,407	51,098	40,051	40,943	44,201	54,173	291,873
Fixed Service Charges	102,587	102,672	102,723	102,809	102,907	102,915	616,613
Usage Charges	278,489	210,934	146,435	151,971	173,956	229,756	1,191,541
Total	381,076	313,606	249,158	254,780	276,863	332,671	1,808,154
2011/12							
Water Use (hcf)	51,110	48,784	40,171	42,328	40,067	51,402	273,862
Fixed Service Charges	102,507	102,438	102,479	102,613	102,505	102,331	614,873
Usage Charges	215,691	200,935	146,706	160,240	152,367	216,810	1,092,749
Total	318,198	303,373	249,185	262,853	254,872	319,141	1,707,622

Table 5 Bank Loan/Private Placement

Cambria Community Services District

Debt Service Estimates

	10-Year Bank Loan	15-Year Bank Loan	20-Year Bank Loan
Project Funding Target	$11,250,000	$11,250,000	$11,250,000
Loan Amount			
Project Funding	$11,250,000	$11,250,000	$11,250,000
Issuance Costs (est. for planning purposes)	75,000	75,000	75,000
Total Loan Amount	11,325,000	11,325,000	11,325,000
Loan Terms			
Term (years)	10	15	20
Interest Rate (est.)	3.25%	3.75%	4.25%
Annual Debt Service	$1,345,000	$1,001,000	$852,000
Total Payments Over Term of Loan	$13,450,000	$15,015,000	$17,040,000
Debt Service per $1 Million of Project Funding	$119,556	$88,978	$75,733

Table 6 Bonds/COPs

Cambria Community Services District

Debt Service Estimates

		20-Year Bond With Reserve	25-Year Bond With Reserve	30-Year Bond With Reserve
Funding Target		$11,250,000	$11,250,000	$11,250,000
Total Debt Issue		$12,490,000	$12,290,000	$12,360,000
Project Funding		$11,250,000	$11,150,000	$11,250,000
Issuance Costs & Reserve Requirement				
Underwriter Discount	1.00%	$124,900	$122,900	$123,600
Issuance Costs/Contingency	est.	150,000	150,000	150,000
Debt Service Reserve Fund		960,200	863,300	827,100
Bond Insurance		tbd	tbd	tbd
Rounding		4,900	3,800	9,300
Total		1,240,000	1,140,000	1,110,000
Financing Terms				
Term (Years)		20	25	30
Est. Average Interest Rate	*on high side*	4.50%	4.90%	5.25%
Annual Debt Service				
Gross Annual Debt Service		960,200	863,300	827,100
Less Interest on Reserve Fund	2.00%	(19,200)	(17,300)	(16,500)
Net Annual Debt Service		**941,000**	**846,000**	**810,600**

Financing costs and interest rates estimated for financial planning purposes.

Table 7
Cambria Community Services District
3-Year Average Revenues & Expenses
Excludes Emergency Water Supply

	2014/15	2015/16	2016/17	3-Year Avg
ANNUAL REVENUES				
Excludes Debt Proceeds & Emergency Supply Charges				
Water Service Charge Revenues	2,000,000	2,300,000	2,600,000	2,300,000
Drought Rate Surcharges	150,000	0	0	50,000
Standby Availability	125,000	125,000	125,000	125,000
Interest Income	1,000	1,000	3,000	1,667
Other Fees and Charges	71,000	70,000	70,000	70,333
Admin/Remod/Wait List/Retrofit/Misc Revs	115,000	115,000	115,000	115,000
Total Revenues	2,462,000	2,611,000	2,913,000	2,662,000
EXPENSES				
Excludes Debt-Financed Capital Projects & Emergency Water Supply Expenses				
Operating & Maintenance				
Salaries & Benefits	684,000	711,000	739,000	711,333
Maintenance	388,000	404,000	420,000	404,000
Services & Supplies	336,000	349,000	363,000	349,333
Professional Services	196,000	204,000	212,000	204,000
Allocated Overhead	531,000	552,000	574,000	552,333
Subtotal	2,135,000	2,220,000	2,308,000	2,221,000
Debt Service for Critical CIP Projects	221,000	221,000	221,000	221,000
Capital & Non-Operating	100,000	150,000	250,000	166,667
Total Expenses	2,456,000	2,591,000	2,779,000	2,608,667

Table 8 Based on Projected 3-Year Average

Cambria Community Services District

Fixed & Variable Cost Recovery Allocation

Excludes Emergency Water Supply

	Projected 3-Year Avg	Cost Recovery % Fixed	Cost Recovery % Variable	Cost Recovery $ Fixed	Cost Recovery $ Variable
REVENUES					
Water Service Charge Revenues	2,300,000				
Drought Rate Surcharges	50,000				
Other Revenues	312,000				
Total	2,662,000				
EXPENSES					
Operating & Maintenance					
Salaries & Benefits	711,333	35%	65%	248,967	462,367
Maintenance	404,000	35%	65%	141,400	262,600
Services & Supplies	349,333	35%	65%	122,267	227,067
Professional Services	204,000	35%	65%	71,400	132,600
Allocated Overhead	552,333	35%	65%	193,317	359,017
Subtotal	2,221,000	35%	65%	777,350	1,443,650
Debt Service for Critical CIP Projects	221,000	35%	65%	77,350	143,650
Capital & Non-Operating	166,667	35%	65%	58,333	108,333
Total Expenses	2,608,667	35%	65%	913,033	1,695,633
NET FUNDING REQUIRED FROM WATER RATES					
Total Expenses	2,608,667	35%	65%	913,033	1,695,633
Less Funding Sources Other Than Rates	(362,000)	100%	0%	(362,000)	0
Net Funding Requirement from Water Rates	2,246,667	25%	75%	551,033	1,695,633

Excludes capital improvement projects funded by grants and debt, but includes associated debt service.

Table 9
Cambria Community Services District
Active Water Accounts by Customer Class & Meter Size

Meter Size	Number of Customers[1]	Water Use 2012/13 (ccf)[2]	Bi-monthly Average Water Use (ccf)
Residential			
Single Family Residential	3,350	191,442	9.5
Multi-Family Residential	133	9,761	12.2
Vacation Rental Units	295	16,953	9.6
Subtotal Residential	3,778	218,156	9.6
Commercial			
5/8" or 3/4" Assumed	204	45,888	37.5
1"	0	0	-
1-1/2"	3	4,622	256.8
2"	27	22,120	136.5
3"	1	325	54.2
4"	0	0	-
6"	1	1,628	271.3
Subtotal Commercial	236	74,583	52.7
Total	4,014	292,739	12.2

1 Source: CCSD Billing Data for Jan/Feb 2014.
2 Source: BWA analysis of annual water consumption data 2012/13.

Table 10
Cambria Community Services District
Commercial Meter Equivalents

Meter Size	Number of Customers	AWWA Meter Capacity (gpm)	Capacity Ratio	Residential Meter Equivalents	Water Use 2012/13	Bi-Monthly Use Per Meter Equiv
Residential						
Single Family	3,350		1.0	3,350	191,442	9.5
Multi-Family	133		1.0	133	9,761	12.2
Vacation Rental Units	295		1.0	295	16,953	9.6
Subtotal Residential	3,778			3,778	218,156	9.6
Commercial						
Accounts by Meter Size						
5/8" or 3/4" Assumed	204	30	1.0	204.0	45,888	37.5
1"	0	50	1.7	0.0	0	0.0
1-1/2"	3	100	3.3	10.0	4,622	77.0
2" or larger	29	160	5.3	154.7	24,073	25.9
Subtotal Commercial	236			368.7	74,583	33.7

Table 11
Cambria Community Services District
Accounts & Meter Equivalents

Accounts by Customer Class		Current Rate Ratios		Proposed Ratios & Meter Equivalents			
Customer Class	Accounts	Current Rates	Rate Ratios	AWWA Meter Capacity (gpm)	Capacity Ratio	Adjusted Ratios[1]	Resid. Meter Equivalents[2]
Residential							
Single Family Residential	3,350	$23.82	1.0		1.00	1.00	3,350.0
Multi-Family Residential	133	23.82			1.00	1.00	133.0
Vacation Rental Units	295	23.82			1.00	1.00	295.0
Subtotal Residential	3,778						3,778.0
Commercial						2x (conservative est.)	
5/8" or 3/4"	204	54.07	2.3	30	1.00	2.00	408.0
1"	0	54.07	2.3	50	1.67	3.33	0.0
1-1/2"	3	54.07	2.3	100	3.33	6.67	20.0
2" or larger	29	54.07	2.3	160	5.33	10.67	309.3
Subtotal	236						737.3
Total	4,014						4,515.3

1 Adjusted Ratio for Commercial accounts conservatively estimated at 2.0x the Capacity Ratio for Residential accounts.
2 Calculated by multiplying the number of accounts for each customer type by the Adjusted Ratios.

Table 12
Cambria Community Services District
Fixed Meter Charge Calculation

	2014/15	2015/16	2016/17
Annual Revenue Requirement from Rates	$2,000,000	$2,300,000	$2,600,000
Fixed Residential Water Charge			
Bi-Monthly Base Charge per Residential Equivalent	$24.00	$25.00	$26.00
Total Residential Meter Equivalents	4,515	4,515	4,515
Annual Revenues from Fixed Meter Charges	$650,208	$677,300	$704,392
% of Annual Revenue Requirement from Rates	32.5%	29.4%	27.1%

Table 13
Cambria Community Services District
Proposed Fixed Meter Charges

		Current Charges	Proposed 2014/15	Proposed 2015/16	Proposed 2016/17
Fixed Bi-Monthly Meter Charges					
Base charge per account regardless of water use					
Residential					
Per Dwelling Unit		$23.82	$24.00	$25.00	$26.00
Commercial					
Meter Size	Capacity Ratio[1]				
5/8" or 3/4"	2.000	$54.07	$48.00	$50.00	$52.00
1"	3.333	54.07	80.00	83.33	86.67
1-1/2"	6.667	54.07	160.00	166.67	173.33
2" & Larger	10.667	54.07	256.00	266.67	277.33

1 Based on analysis of water billing data and standard AWWA meter capacities.

Table 14
Cambria Community Services District
Water Quantity Charge Calculation

	2014/15	2015/16	2016/17
Annual Revenue Requirement from Rates	$2,000,000	$2,300,000	$2,600,000
Annual Revenues from Fixed Meter Charges	$650,208	$677,300	$704,392
% of Annual Revenue Requirement from Rates	32.5%	29.4%	27.1%
Water Quantity Charges			
Revenue Requirement from Water Sales	$1,349,792	$1,622,700	$1,895,608
% of Annual Revenue Requirement from Rates	67.5%	70.6%	72.9%
Est. Total Units of Metered Water Use (ccf)[1]	225,000	225,000	225,000
Average Rate per Unit ($/ccf)	$6.00	$7.21	$8.42
Equivalent Rate per 100 gallons	*$0.80*	*$0.96*	*$1.13*

1 Actual use may vary, lower use may result in need for additional rate increases.

Table 15
Cambria Community Services District
Water Quantity Charges A

Alternative A
Uniform Rate for All Water Use

	2014/15	2015/16	2016/17
WATER QUANTITY CHARGES ($/ccf)			
Rate for All Water Use	$6.00	$7.25	$8.50
Equivalent Rate per 100 Gallons	*$0.80*	*$0.97*	*$1.14*

Table 16
Cambria Community Services District
Water Quantity Charges

Alternative B
3-Tiered Rate Structure

			2014/15	2015/16	2016/17
WATER USE BY TIER					
Tier	Use in Tier	% Use in Tier		Projected Water Use (ccf)	
Tier 1	1 - 4 ccf	32%	72,000	72,000	72,000
Tier 2	5 - 16 ccf	38%	85,500	85,500	85,500
Tier 3	>16 ccf	30%	67,500	67,500	67,500
Total		100%	225,000	225,000	225,000
WATER QUANTITY CHARGES ($/ccf)					
Tier	Use in Tier				
Tier 1	1 - 4 ccf		$3.00	$3.63	$4.25
Tier 2	5 - 16 ccf		6.00	7.25	$8.50
Tier 3	>16 ccf		9.00	10.88	$12.75
REVENUES					
Tier 1	1 - 4 ccf		$216,000	$261,360	$306,000
Tier 2	5 - 16 ccf		513,000	619,875	726,750
Tier 3	>16 ccf		607,500	734,400	860,625
Subtotal			$1,336,500	$1,615,635	$1,893,375
Weighted Average			*$5.94*	*$7.18*	*$8.42*
Revenue Target			*$1,349,792*	*$1,622,700*	*$1,895,608*

Table 17
Cambria Community Services District
Water Quantity Charges

Alternative C
Esclating Rates

		2014/15	2015/16	2016/17
WATER USE BY TIER				
Water Use (ccf)	% Use	Projected Water Use (ccf)		
1	8.0%	18,000	18,000	18,000
2	7.5%	16,900	16,900	16,900
3	7.0%	15,800	15,800	15,800
4	6.5%	14,600	14,600	14,600
5	6.0%	13,500	13,500	13,500
6	5.5%	12,400	12,400	12,400
7	5.0%	11,300	11,300	11,300
8+	54.5%	122,600	122,600	122,600
Total	100.0%	225,000	225,000	225,000
WATER QUANTITY CHARGES ($/ccf)				
Water Use (ccf)				
1		$1.00	$1.20	$1.40
2		2.00	2.40	2.80
3		3.00	3.60	4.20
4		4.00	4.80	5.60
5		5.00	6.00	7.00
6		6.00	7.20	8.40
7		7.00	8.40	9.80
8+		8.00	9.60	11.20
REVENUES				
1		$18,000	$21,600	$25,200
2		33,800	40,560	47,320
3		47,400	56,880	66,360
4		58,400	70,080	81,760
5		67,500	81,000	94,500
6		74,400	89,280	104,160
7		79,100	94,920	110,740
8+		980,800	1,176,960	1,373,120
Total		1,359,400	1,631,280	1,903,160
Weighted Average		$6.04	$7.25	$8.46
Revenue Target		*$1,349,792*	*$1,622,700*	*$1,895,608*

Table 18
Cambria Community Services District
Conceptual Water Rates Alternatives

Water Rate Only
Excludes Emergency Water Supply

		2014/15	2015/16	2016/17
FIXED BI-MONTHLY METER CHARGE				
Residential				
Per Dwelling Unit		$24.00	$25.00	$26.00
Commercial				
Meter Size	Capacity Ratio			
5/8" or 3/4"	2.000	$48.00	$50.00	$52.00
1"	3.333	80.00	83.33	86.67
1-1/2"	6.667	160.00	166.67	173.33
2" & Larger	10.667	256.00	266.67	277.33
WATER QUANTITY CHARGES ($/ccf)				
Alternative A: Uniform Rate				
Rate for All Water Use		$6.00	$7.25	$8.50
Alternative B: 3-Tiered Rate Structure				
Tier	Use in Tier			
Tier 1	1 - 4 ccf	$3.00	$3.63	$4.25
Tier 2	5 - 16 ccf	6.00	7.25	8.50
Tier 3	>16 ccf	9.00	10.88	12.75
Alternative C: Escalating Rates				
Water Use (ccf)				
1		$1.00	$1.20	$1.40
2		2.00	2.40	2.80
3		3.00	3.60	4.20
4		4.00	4.80	5.60
5		5.00	6.00	7.00
6		6.00	7.20	8.40
7		7.00	8.40	9.80
8+		8.00	9.60	11.20

Table 19
Cambria Community Services District
Rate Impacts With Approx. 20% Conservation

Alternative A
Uniform Rate for All Water Use
Excludes Emergency Water Supply

	Bi-Monthly Use (ccf)	% of Bills at or Below	With 20% Conservation	Current Monthly Bill	Monthly Water Bills with Approx 20% Conservation		
					2014/15	2015/16	2016/17
Single Family Residential Rate Impacts				Without Conservation			
Low Use	4	25%	3	$11.91	$21.00	$23.38	$25.75
Median Use	8	50%	6	17.96	30.00	34.25	38.50
Average Use	10	65%	8	24.01	36.00	41.50	47.00
Mod-High Use	12	75%	10	30.06	42.00	48.75	55.50
High Use	20	90%	16	54.59	59.99	70.50	81.00
Sample Commercial & Multi-Family Residential Rate Impacts							
Meter Size 5/8" or 3/4"							
Low Use	8		6	$33.73	$42.00	$46.75	$51.50
Moderate Use	15		12	57.14	59.99	68.50	77.00
Mod-High Use	25		20	91.59	83.99	97.50	111.00
Meter Size 2"							
Low Use	50		40	$202.64	$247.98	$278.34	$308.67
Moderate Use	100		80	386.52	367.96	423.34	478.67
Mod-High Use	200		160	805.02	607.93	713.34	818.67

Table 20
Cambria Community Services District
Rate Impacts With Approx. 20% Conservation

Alternative B
3-Tiered Rate Structure
Excludes Emergency Water Supply

	Bi-Monthly Use (ccf)	% of Bills at or Below	With 20% Conservation	Current Monthly Bill	Monthly Water Bills with Approx 20% Conservation		
					2014/15	2015/16	2016/17
Single Family Residential Rate Impacts				Without Conservation			
Low Use	4	25%	3	$11.91	$16.50	$17.95	$19.38
Median Use	8	50%	6	17.96	24.00	27.01	30.00
Average Use	10	65%	8	24.01	30.00	34.26	38.50
Mod-High Use	12	75%	10	30.06	36.00	41.51	47.00
High Use	20	90%	16	54.59	54.00	63.26	72.50
Sample Commercial & Multi-Family Residential Rate Impacts							
Meter Size 5/8" or 3/4"							
Low Use	8		6	$33.73	$36.00	$39.51	$43.00
Moderate Use	15		12	57.14	54.00	61.26	68.50
Mod-High Use	25		20	91.59	84.00	97.52	111.00
Meter Size 2"							
Low Use	50		40	$202.64	$278.00	$314.66	$351.17
Moderate Use	100		80	386.52	458.00	532.26	606.17
Mod-High Use	200		160	805.02	818.00	967.46	1,116.17

Table 21
Cambria Community Services District
Rate Impacts With Approx. 20% Conservation

Alternative C
Esclating Rates
Excludes Emergency Water Supply

	Bi-Monthly Use (ccf)	% of Bills at or Below	With 20% Conservation	Current Monthly Bill	Monthly Water Bills with Approx 20% Conservation		
					2014/15	2015/16	2016/17
Single Family Residential Rate Impacts				Without Conservation			
Low Use	4	25%	3	$11.91	$15.00	$16.10	$17.20
Median Use	8	50%	6	17.96	22.50	25.10	27.70
Average Use	10	65%	8	24.01	30.00	34.10	38.20
Mod-High Use	12	75%	10	30.06	38.00	43.70	49.40
High Use	20	90%	16	54.59	62.00	72.50	83.00
Sample Commercial & Multi-Family Residential Rate Impacts							
Meter Size 5/8" or 3/4"							
Low Use	8		6	$33.73	$34.50	$34.50	$40.70
Moderate Use	15		12	57.14	58.00	58.00	73.60
Mod-High Use	25		20	91.59	90.00	90.00	118.40
Meter Size 2"							
Low Use	50		40	$202.64	$274.00	$308.54	$343.07
Moderate Use	100		80	386.52	434.00	500.54	567.07
Mod-High Use	200		160	805.02	754.00	884.54	1,015.07

Table 22

Cambria Community Services District

Rate Impacts

Water Rates Only

Excludes Emergency Water Supply

	Bi-Monthly Use (ccf)	% of Bills at or Below	With 20% Conservation	Current Monthly Bill	Monthly Bill with 20% Conservation								
					2014/15			2015/16			2016/17		
Single Family Residential Rate Impacts				Without Conservation	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C
Low Use	4	25%	3	$11.91	$21.00	$16.50	$15.00	$23.38	$17.95	$16.10	$25.75	$19.38	$17.20
Median Use	8	50%	6	17.96	30.00	24.00	22.50	34.25	27.01	25.10	38.50	30.00	27.70
Average Use	10	65%	8	24.01	36.00	30.00	30.00	41.50	34.26	34.10	47.00	38.50	38.20
Mod-High Use	12	75%	10	30.06	42.00	36.00	38.00	48.75	41.51	43.70	55.50	47.00	49.40
High Use	20	90%	16	54.59	59.99	54.00	62.00	70.50	63.26	72.50	81.00	72.50	83.00
Sample Commercial & Multi-Family Residential Rate Impacts													
Meter Size 5/8" or 3/4"													
Low Use	8		6	$33.73	$42.00	$36.00	$34.50	$46.75	$39.51	$34.50	$51.50	$43.00	$40.70
Moderate Use	15		12	57.14	59.99	54.00	58.00	68.50	61.26	58.00	77.00	68.50	73.60
Mod-High Use	25		20	91.59	83.99	84.00	90.00	97.50	97.52	90.00	111.00	111.00	118.40
Meter Size 2"													
Low Use	50		40	202.64	$247.98	$278.00	$274.00	$278.34	$314.66	$308.54	$308.67	$351.17	$343.07
Moderate Use	100		80	386.52	367.96	458.00	434.00	423.34	532.26	500.54	478.67	606.17	567.07
Mod-High Use	200		160	805.02	607.93	818.00	754.00	713.34	967.46	884.54	818.67	1,116.17	1,015.07

Table 23 **Emergency Water Supply**
Cambria Community Services District Fixed Capital Cost Recovery
Emergency Water Supply: Capital Cost Recovery, Fixed Charges
Billed on an Ongoing Basis

Emergency Water Supply Annual Debt Service		$800,000
Contingency 20%		160,000
Minimum Facility Maintenance Charges		50,000
Total		1,010,000
Fixed Cost Recovery %		35%
Fixed Cost Recovery $		$353,500
Divided by Total Residential Meter Equivalents		4,515
Charge per Residential Meter Equivalent		
Annual		$78.29
Bi-Monthly		13.05
Rounded		*13.00*
Bi-Monthly Fixed Charge		
Residential *Charge per Dwelling Unit*		$13.00
Commercial		
Meter Size	Capacity Ratio[1]	
5/8" or 3/4"	2.00	$26.00
1"	3.33	43.33
1-1/2"	6.67	86.67
2" or larger	10.67	138.67

1 Based on analysis of water billing data and standard AWWA meter capacities.

Table 24 **Emergency Water Supply**
Cambria Community Services District **Alternative A: Uniform Rate**
Emergency Water Supply: Capital Cost Recovery, Variable Charges
Billed on an Ongoing Basis

Emergency Water Supply Annual Debt Service	$800,000
Contingency 20%	160,000
Minimum Facility Maintenance Charges	50,000
Total	1,010,000
Variable Cost Recovery %	65%
Variable Cost Recovery $	$656,500
Total Projected Units of Water Sold[1]	225,000
Alternative A: Uniform Rate on All Use	
Charge per ccf for all water use	$2.918
Proposed	$2.95

_____

1 Assumes 20% cutback in water use due to lasting effects of drought response and price elasticity

Table 25 **Emergency Water Supply**
Cambria Community Services District **Alternative B: 3-Tiered Rate Structure**
Emergency Water Supply: Capital Cost Recovery, Variable Charges
Billed on an Ongoing Basis

Emergency Water Supply Annual Debt Service	$800,000
Contingency 20%	160,000
Minimum Facility Maintenance Charges	50,000
Total	1,010,000
Variable Cost Recovery %	65%
Variable Cost Recovery $	$656,500
Total Projected Units of Water Sold[1]	225,000

Alternative B: 3-Tiered Rate Structure (Reduced Impact on Low Use)

Water Use Tier	Use in Tier	% Use in Tier	
Tier 1	1 - 4 ccf	32%	$1.50
Tier 2	5 - 16 ccf	38%	3.00
Tier 3	>16 ccf	30%	4.50
		100%	
Weighted Average Rate			$2.97
Target			$2.92

Table 26 **Emergency Water Supply**
Cambria Community Services District **Alternative C: Escalating Rates**
Emergency Water Supply: Capital Cost Recovery, Variable Charges
Billed on an Ongoing Basis

Emergency Water Supply Annual Debt Service	$800,000
Contingency 20%	160,000
Minimum Facility Maintenance Charges	50,000
Total	1,010,000
Variable Cost Recovery %	65%
Variable Cost Recovery $	$656,500
Total Projected Units of Water Sold[1]	225,000

Alternative C: Escalating Rates

Water Use (ccf)	% Use in Tier	
1	9.0%	$1.00
2	8.7%	1.40
3	8.3%	1.80
4	7.8%	2.20
5	7.4%	2.60
6	7.0%	3.00
7	6.3%	3.40
8+	45.5%	3.90
	100.0%	
Weighted Average Rate		$2.92
Target		$2.92

Table 27
Cambria Community Services District
Emergency Water Supply: Capital Cost Recovery

Emergency Water Supply
Total Capital Cost Recovery

Fixed Bi-Monthly Meter Charges

Residential *Charge per Dwelling Unit*		$13.00
Commercial		
Meter Size	Capacity Ratio[1]	
5/8" or 3/4"	2.00	$26.00
1"	3.33	43.33
1-1/2"	6.67	86.67
2" or larger	10.67	138.67

Water Quantity Charges

Alternative A: Uniform Rate on All Use

Charge per ccf for all water use	$2.95

Alternative B: 3-Tiered Rate Structure (Reduced Impact on Low Use)

Water Use Tier	Use in Tier	
Tier 1	1 - 4 ccf	$1.50
Tier 2	5 - 16 ccf	3.00
Tier 3	>16 ccf	4.50

Alternative C: Escalating Rates

Water Use (ccf)	
1	$1.00
2	1.40
3	1.80
4	2.20
5	2.60
6	3.00
7	3.40
8+	3.90

1 Based on analysis of water billing data and standard AWWA meter capacities.

Table 28
Cambria Community Services District
Emergency Water Supply: Operating Cost Recovery
Billed on an Ongoing Basis

Emergency Water Supply
Alternative A: Uniform Rate
July-Oct Operating Charges

4 Months Emergency Supply Variable Operating Expenses 4 Months	$220,000
Contingency 20%	44,000
Total	264,000
Total Projected Units of Water Sold July - October[1]	85,000
Alternative A: Uniform Rate on All Use	
Charge per ccf for all water use	$3.106
Rounded	$3.10

1 Estimated at 75% of water use in 2012/13 to account for conservtion and drought response.

Table 29
Cambria Community Services District
Emergency Water Supply: Operating Cost Recovery
Billed on an Ongoing Basis

Emergency Water Supply
Alternative B: 3-Tiered Rate Structure
July-Oct Operating Charges

4 Months Emergency Supply Variable Operating Expenses 4	$220,000
Contingency 20%	44,000
Total	264,000
Total Projected Units of Water Sold July - October[1]	85,000

Alternative B: 3-Tiered Rate Structure (Reduced Impact on Low Use)

Water Use Tier	Use in Tier	% Use in Tier	
Tier 1	1 - 4 ccf	32%	$1.50
Tier 2	5 - 16 ccf	38%	3.00
Tier 3	>16 ccf	30%	5.00
		100%	
Weighted Average Rate			$3.12
Target			$3.11

1 Estimated at 75% of water use in 2012/13 to account for conservtion and drought response.

Table 30
Cambria Community Services District
Emergency Water Supply: Operating Cost Recovery
Billed on an Ongoing Basis

Emergency Water Supply
Alternative C: Escalating Rates
July-Oct Operating Charges

4 Months Emergency Supply Variable Operating Expenses 4 Months	$220,000
Contingency 20%	44,000
Total	264,000
Total Projected Units of Water Sold July - October[1]	85,000

Alternative C: Escalating Rates

Water Use (ccf)	% Use in Tier	
1	9.0%	$0.75
2	8.7%	1.25
3	8.3%	1.75
4	7.8%	2.25
5	7.4%	2.75
6	7.0%	3.25
7	6.3%	3.75
8+	45.5%	4.25
	100.0%	
Weighted Average Rate		$3.10
Target		$3.11

1 Estimated at 75% of water use in 2012/13 to account for conservtion and drought response.

Table 31
Cambria Community Services District
Emergency Water Supply: Operating Cost Recovery

Emergency Water Supply
July-Oct Operating Charges

Bi-Monthly Fixed Charges

Residential *Charge per Dwelling Unit*		$13.00
Commercial		
Meter Size	Capacity Ratio[1]	
5/8" or 3/4"	2.00	$26.00
1"	3.33	43.33
1-1/2"	6.67	86.67
2" or larger	10.67	138.67

Water Quantity Charges

Alternative A: Uniform Rate on All Use

Charge per ccf for all water use	$3.10

Alternative B: 3-Tiered Rate Structure (Reduced Impact on Low Use)

Water Use Tier	Use in Tier	
Tier 1	1 - 4 ccf	$1.50
Tier 2	5 - 16 ccf	3.00
Tier 3	>16 ccf	5.00

Alternative C: Escalating Rates

Water Use (ccf)	
1	$0.75
2	1.25
3	1.75
4	2.25
5	2.75
6	3.25
7	3.75
8+	4.25

1 Estimated at 75% of water use in 2012/13 to account for conservtion & drought response.

Table 32

Cambria Community Services District

Rate Impacts of Emergency Water Supply Capital Cost Recovery

	% of Bills at or Below	Bi-Monthly Use 20% Conservation	Monthly Charges *Billed Througout Year*			Plus O&M Surcharges *During Periods of Operation*		
Single Family Residential Rate Impacts			**Alt A**	**Alt B**	**Alt C**	**Alt A**	**Alt B**	**Alt C**
Low Use	25%	3	**$10.93**	**$8.75**	**$8.60**	**$4.65**	**$2.25**	**$1.88**
Median Use	50%	6	**15.35**	**12.50**	**12.50**	**9.30**	**6.00**	**6.00**
Average Use	65%	8	**18.30**	**15.50**	**16.15**	**12.40**	**9.00**	**10.00**
Mod-High Use	75%	10	**21.25**	**18.50**	**20.05**	**15.50**	**12.00**	**14.25**
High Use	90%	16	**30.10**	**27.50**	**31.75**	**24.80**	**21.00**	**27.00**
Sample Commercial & Multi-Family Residential Rate Impacts								
Meter Size 5/8" or 3/4"								
Low Use		6	**$21.85**	**$17.50**	**$19.00**	**$9.30**	**$6.00**	**$6.00**
Moderate Use		12	**30.70**	**26.50**	**30.45**	**18.60**	**15.00**	**18.50**
Mod-High Use		20	**42.50**	**41.50**	**46.05**	**31.00**	**31.00**	**35.50**
Meter Size 2"								
Low Use		40	**$128.33**	**$142.83**	**$141.38**	**$62.00**	**$81.00**	**$78.00**
Moderate Use		80	**187.33**	**232.83**	**219.38**	**124.00**	**181.00**	**163.00**
Mod-High Use		160	**305.33**	**412.83**	**375.38**	**248.00**	**381.00**	**333.00**

Table 33
Cambria Community Services District
Total Combined Rate Impacts

Total Combined Rate Impacts: Water Rates + Emergency Water Supply Surcharges

	Bi-Monthly Use (ccf)	% of Bills at or Below	With 20% Conservation	Current Monthly Bill	Monthly Bill + EWS Capital Surcharge (with 20% Conservation)									Plus EWS O&M		
					2014/15			2015/16			2016/17			*During Periods of Operation*		
Single Family Residential Rate Impacts				Without Conservation	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C	Alt A	Alt B	Alt C
Low Use	4	25%	3	$11.91	$31.92	$25.25	$23.60	$34.30	$26.70	$24.70	$36.68	$28.13	$25.80	$4.65	$2.25	$1.88
Median Use	8	50%	6	17.96	45.35	36.50	35.00	49.60	39.51	37.60	53.85	42.50	40.20	9.30	6.00	6.00
Average Use	10	65%	8	24.01	54.30	45.50	46.15	59.80	49.76	50.25	65.30	54.00	54.35	12.40	9.00	10.00
Mod-High Use	12	75%	10	30.06	63.25	54.50	58.05	70.00	60.01	63.75	76.75	65.50	69.45	15.50	12.00	14.25
High Use	20	90%	16	54.59	90.09	81.50	93.75	100.60	90.76	104.25	111.10	100.00	114.75	24.80	21.00	27.00
Sample Commercial & Multi-Family Residential Rate Impacts																
Meter Size 5/8" or 3/4"																
Low Use	8		6	$33.73	$63.85	$53.50	$53.50	$68.60	$57.01	$53.50	$73.35	$60.50	$59.70	$9.30	$6.00	$6.00
Moderate Use	15		12	57.14	90.69	80.50	88.45	99.20	87.76	88.45	107.70	95.00	104.05	18.60	15.00	18.50
Mod-High Use	25		20	91.59	126.49	125.50	136.05	140.00	139.02	136.05	153.50	152.50	164.45	31.00	31.00	35.50
Meter Size 2"																
Low Use	50		40	$202.64	$376.31	$420.83	$415.38	$406.67	$457.49	$449.92	$437.00	$494.00	$484.45	$62.00	$81.00	$78.00
Moderate Use	100		80	386.52	555.30	690.83	653.38	610.67	765.09	719.92	666.00	839.00	786.45	124.00	181.00	163.00
Mod-High Use	200		160	805.02	913.26	1,230.83	1,129.38	1,018.67	1,380.29	1,259.92	1,124.00	1,529.00	1,390.45	248.00	381.00	333.00

Water Use Analysis

Table B-1 | All Accounts: Annual Use
Cambria Community Services District | Median Bi-Monthly Use: 8.0 hcf
Consumption Block Analysis 2012/13 (All Accounts) | Average Bi-Monthly Use: 13.1 hcf

Bi-Monthly	Number of Bills				Water Use (hcf)		Use Through Break	
Use (hcf)	In Block	% of Total	Cumulative	Cumulative %	In Block	% of Ttl	Use (hcf)	% of Ttl
0 (est)	300	1.3%	300	1.3%	0	0.0%	0	0.0%
1	1,421	6.1%	1,721	7.4%	1,421	0.5%	22,862	7.6%
2	1,226	5.3%	2,947	12.7%	2,452	0.8%	44,303	14.6%
3	1,318	5.7%	4,265	18.4%	3,954	1.3%	64,518	21.3%
4	1,432	6.2%	5,697	24.6%	5,728	1.9%	83,415	27.5%
5	1,558	6.7%	7,255	31.3%	7,790	2.6%	100,880	33.3%
6	1,592	6.9%	8,847	38.2%	9,552	3.2%	116,787	38.6%
7	1,611	7.0%	10,458	45.2%	11,277	3.7%	131,102	43.3%
8	1,451	6.3%	11,909	51.4%	11,608	3.8%	143,806	47.5%
9	1,334	5.8%	13,243	57.2%	12,006	4.0%	155,059	51.2%
10	1,281	5.5%	14,524	62.7%	12,810	4.2%	164,978	54.5%
11	1,095	4.7%	15,619	67.4%	12,045	4.0%	173,616	57.3%
12	1,015	4.4%	16,634	71.8%	12,180	4.0%	181,159	59.8%
13	862	3.7%	17,496	75.5%	11,206	3.7%	187,687	62.0%
14	746	3.2%	18,242	78.8%	10,444	3.4%	193,353	63.9%
15	593	2.6%	18,835	81.3%	8,895	2.9%	198,273	65.5%
16	461	2.0%	19,296	83.3%	7,376	2.4%	202,600	66.9%
17	462	2.0%	19,758	85.3%	7,854	2.6%	206,466	68.2%
18	378	1.6%	20,136	86.9%	6,804	2.2%	209,870	69.3%
19	336	1.5%	20,472	88.4%	6,384	2.1%	212,896	70.3%
20	297	1.3%	20,769	89.7%	5,940	2.0%	215,586	71.2%
21	247	1.1%	21,016	90.7%	5,187	1.7%	217,979	72.0%
22	216	0.9%	21,232	91.7%	4,752	1.6%	220,125	72.7%
23	182	0.8%	21,414	92.5%	4,186	1.4%	222,055	73.3%
24	161	0.7%	21,575	93.1%	3,864	1.3%	223,803	73.9%
25	158	0.7%	21,733	93.8%	3,950	1.3%	225,390	74.4%
26	126	0.5%	21,859	94.4%	3,276	1.1%	226,819	74.9%
27	101	0.4%	21,960	94.8%	2,727	0.9%	228,122	75.3%
28	86	0.4%	22,046	95.2%	2,408	0.8%	229,324	75.7%
29	80	0.3%	22,126	95.5%	2,320	0.8%	230,440	76.1%
30	59	0.3%	22,185	95.8%	1,770	0.6%	231,476	76.4%
31	50	0.2%	22,235	96.0%	1,550	0.5%	232,453	76.8%
32	71	0.3%	22,306	96.3%	2,272	0.8%	233,380	77.1%
33	54	0.2%	22,360	96.5%	1,782	0.6%	234,236	77.4%
34	37	0.2%	22,397	96.7%	1,258	0.4%	235,038	77.6%
35	34	0.1%	22,431	96.8%	1,190	0.4%	235,803	77.9%
36	38	0.2%	22,469	97.0%	1,368	0.5%	236,534	78.1%
37	31	0.1%	22,500	97.1%	1,147	0.4%	237,227	78.3%
38	31	0.1%	22,531	97.3%	1,178	0.4%	237,889	78.6%
39	25	0.1%	22,556	97.4%	975	0.3%	238,520	78.8%
40	24	0.1%	22,580	97.5%	960	0.3%	239,126	79.0%
41	25	0.1%	22,605	97.6%	1,025	0.3%	239,708	79.2%
42	17	0.1%	22,622	97.7%	714	0.2%	240,265	79.4%
43	17	0.1%	22,639	97.7%	731	0.2%	240,805	79.5%
44	26	0.1%	22,665	97.9%	1,144	0.4%	241,328	79.7%
45	11	0.0%	22,676	97.9%	495	0.2%	241,825	79.9%
46	20	0.1%	22,696	98.0%	920	0.3%	242,311	80.0%
47	17	0.1%	22,713	98.1%	799	0.3%	242,777	80.2%
48	14	0.1%	22,727	98.1%	672	0.2%	243,226	80.3%
49	16	0.1%	22,743	98.2%	784	0.3%	243,661	80.5%
50	8	0.0%	22,751	98.2%	400	0.1%	244,080	80.6%
51-100	203	0.9%	22,954	99.1%	13,689	4.5%	258,019	85.2%
101-200	109	0.5%	23,063	99.6%	15,357	5.1%	272,376	90.0%
201-300	46	0.2%	23,109	99.8%	10,973	3.6%	279,449	92.3%
301-400	16	0.1%	23,125	99.8%	5,442	1.8%	283,791	93.7%
401-500	8	0.0%	23,133	99.9%	3,480	1.1%	286,971	94.8%
500-1000	25	0.1%	23,158	100.0%	16,950	5.6%	293,421	96.9%
>1000	4	0.0%	23,162	100.0%	13,366	4.4%	302,787	100.0%
Total	23,162	100.0%			302,787	100.0%		

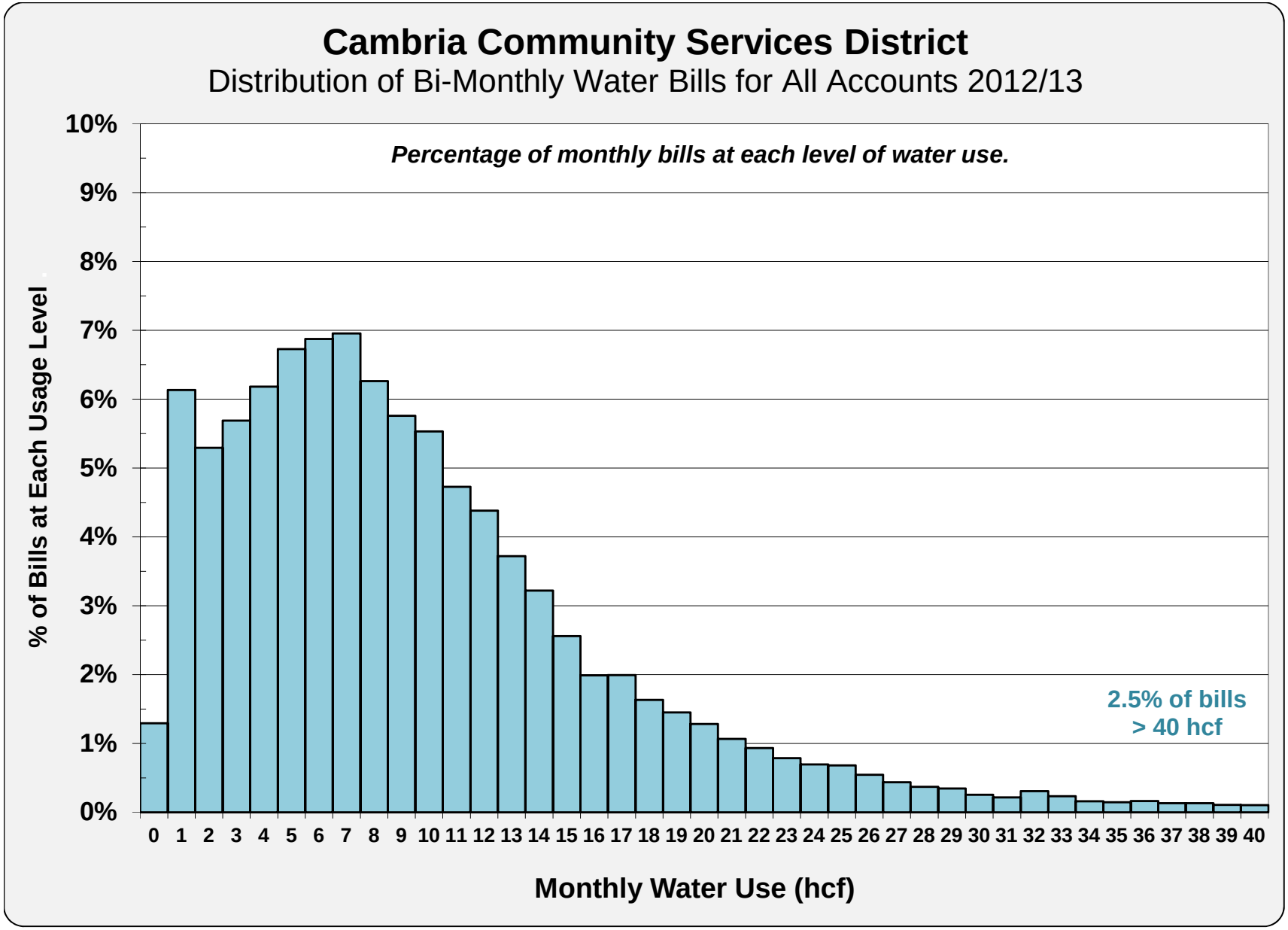

Cambria Community Services District
Distribution of Bi-Monthly Water Bills for All Accounts 2012/13
Percentage of monthly bills at each level of water use.
% of Bills at Each Usage Level
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
2.5% of bills
> 40 hcf
Monthly Water Use (hcf)

Table B-2
Cambria Community Services District
Consumption Block Analysis 2012/13 (Residential)

Residential Accounts Only
Median Bi-Monthly Use: 7.5 hcf
Average Bi-Monthly Use: 10.0 hcf

Bi-Monthly	Number of Bills				Water Use (hcf)		Use Through Break	
Use (hcf)	In Block	% of Total	Cumulative	Cumulative %	In Block	% of Ttl	Use (hcf)	% of Ttl
0 (est)	260	1.3%	260	1.3%	0	0.0%	0	0.0%
1	1,191	5.9%	1,451	7.2%	1,191	0.6%	19,826	9.9%
2	1,037	5.2%	2,488	12.4%	2,074	1.0%	38,461	19.1%
3	1,160	5.8%	3,648	18.2%	3,480	1.7%	56,059	27.9%
4	1,270	6.3%	4,918	24.5%	5,080	2.5%	72,497	36.0%
5	1,383	6.9%	6,301	31.4%	6,915	3.4%	87,665	43.6%
6	1,427	7.1%	7,728	38.5%	8,562	4.3%	101,450	50.4%
7	1,445	7.2%	9,173	45.7%	10,115	5.0%	113,808	56.5%
8	1,295	6.4%	10,468	52.1%	10,360	5.1%	124,721	62.0%
9	1,197	6.0%	11,665	58.1%	10,773	5.4%	134,339	66.7%
10	1,163	5.8%	12,828	63.9%	11,630	5.8%	142,760	70.9%
11	992	4.9%	13,820	68.8%	10,912	5.4%	150,018	74.5%
12	914	4.6%	14,734	73.4%	10,968	5.4%	156,284	77.7%
13	771	3.8%	15,505	77.2%	10,023	5.0%	161,636	80.3%
14	660	3.3%	16,165	80.5%	9,240	4.6%	166,217	82.6%
15	542	2.7%	16,707	83.2%	8,130	4.0%	170,138	84.5%
16	413	2.1%	17,120	85.2%	6,608	3.3%	173,517	86.2%
17	401	2.0%	17,521	87.2%	6,817	3.4%	176,483	87.7%
18	323	1.6%	17,844	88.8%	5,814	2.9%	179,048	89.0%
19	285	1.4%	18,129	90.3%	5,415	2.7%	181,290	90.1%
20	258	1.3%	18,387	91.5%	5,160	2.6%	183,247	91.0%
21	212	1.1%	18,599	92.6%	4,452	2.2%	184,946	91.9%
22	184	0.9%	18,783	93.5%	4,048	2.0%	186,433	92.6%
23	156	0.8%	18,939	94.3%	3,588	1.8%	187,736	93.3%
24	140	0.7%	19,079	95.0%	3,360	1.7%	188,883	93.8%
25	135	0.7%	19,214	95.7%	3,375	1.7%	189,890	94.3%
26	103	0.5%	19,317	96.2%	2,678	1.3%	190,762	94.8%
27	80	0.4%	19,397	96.6%	2,160	1.1%	191,531	95.2%
28	69	0.3%	19,466	96.9%	1,932	1.0%	192,220	95.5%
29	67	0.3%	19,533	97.2%	1,943	1.0%	192,840	95.8%
30	48	0.2%	19,581	97.5%	1,440	0.7%	193,393	96.1%
31	40	0.2%	19,621	97.7%	1,240	0.6%	193,898	96.3%
32	53	0.3%	19,674	97.9%	1,696	0.8%	194,363	96.6%
33	45	0.2%	19,719	98.2%	1,485	0.7%	194,775	96.8%
34	26	0.1%	19,745	98.3%	884	0.4%	195,142	97.0%
35	27	0.1%	19,772	98.4%	945	0.5%	195,483	97.1%
36	27	0.1%	19,799	98.6%	972	0.5%	195,797	97.3%
37	23	0.1%	19,822	98.7%	851	0.4%	196,084	97.4%
38	23	0.1%	19,845	98.8%	874	0.4%	196,348	97.6%
39	16	0.1%	19,861	98.9%	624	0.3%	196,589	97.7%
40	16	0.1%	19,877	99.0%	640	0.3%	196,814	97.8%
41	17	0.1%	19,894	99.0%	697	0.3%	197,023	97.9%
42	11	0.1%	19,905	99.1%	462	0.2%	197,215	98.0%
43	11	0.1%	19,916	99.2%	473	0.2%	197,396	98.1%
44	22	0.1%	19,938	99.3%	968	0.5%	197,566	98.2%
45	6	0.0%	19,944	99.3%	270	0.1%	197,714	98.2%
46	12	0.1%	19,956	99.4%	552	0.3%	197,856	98.3%
47	8	0.0%	19,964	99.4%	376	0.2%	197,986	98.4%
48	8	0.0%	19,972	99.4%	384	0.2%	198,108	98.4%
49	8	0.0%	19,980	99.5%	392	0.2%	198,222	98.5%
50	4	0.0%	19,984	99.5%	200	0.1%	198,328	98.5%
51-100	86	0.4%	20,070	99.9%	5,327	2.6%	200,155	99.4%
101-200	11	0.1%	20,081	100.0%	1,436	0.7%	200,991	99.9%
201-300	4	0.0%	20,085	100.0%	952	0.5%	201,243	100.0%
301-400	1	0.0%	20,086	100.0%	322	0.2%	201,265	100.0%
401-500	0	0.0%	20,086	100.0%	0	0.0%	201,265	100.0%
500-1000	0	0.0%	20,086	100.0%	0	0.0%	201,265	100.0%
>1000	0	0.0%	20,086	100.0%	0	0.0%	201,265	100.0%
Total	20,086	100.0%			201,265	100.0%		

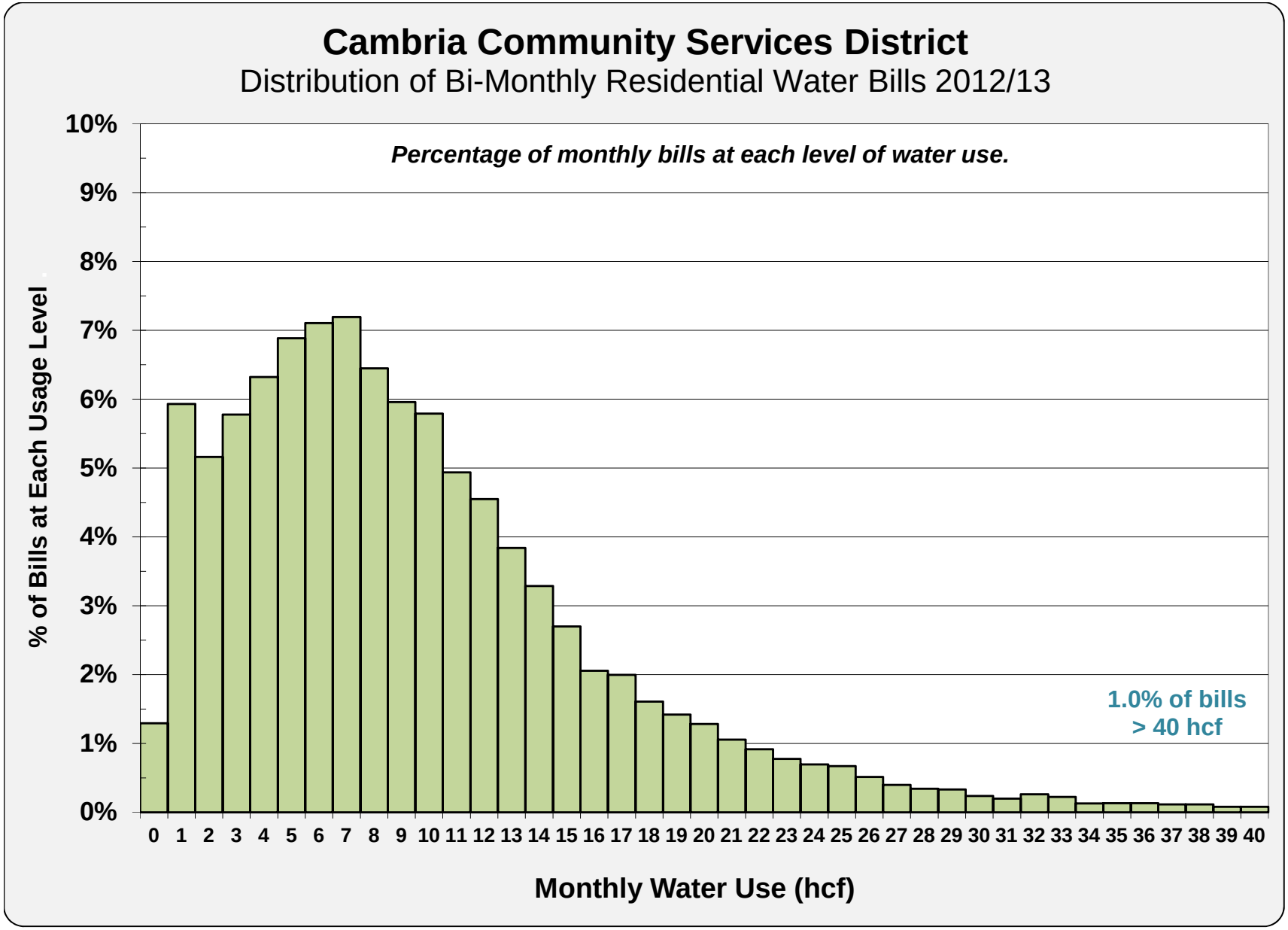

Cambria Community Services District
Distribution of Bi-Monthly Residential Water Bills 2012/13
Percentage of monthly bills at each level of water use.
% of Bills at Each Usage Level
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
1.0% of bills
> 40 hcf
Monthly Water Use (hcf)

Table B-3
Cambria Community Services District
Consumption Block Analysis 2012/13 (Commercial)

Commercial Accounts Only
Median Bi-Monthly Use: 9.0 hcf
Average Bi-Monthly Use: 33.0 hcf

Bi-Monthly	Number of Bills				Water Use (hcf)		Use Through Break	
Use (hcf)	In Block	% of Total	Cumulative	Cumulative %	In Block	% of Ttl	Use (hcf)	% of Ttl
0 (est)	40	1.3%	40	1.3%	0	0.0%	0	0.0%
1	230	7.5%	270	8.8%	230	0.2%	3,036	3.0%
2	189	6.1%	459	14.9%	378	0.4%	5,842	5.8%
3	158	5.1%	617	20.1%	474	0.5%	8,459	8.3%
4	162	5.3%	779	25.3%	648	0.6%	10,918	10.8%
5	175	5.7%	954	31.0%	875	0.9%	13,215	13.0%
6	165	5.4%	1,119	36.4%	990	1.0%	15,337	15.1%
7	166	5.4%	1,285	41.8%	1,162	1.1%	17,294	17.0%
8	156	5.1%	1,441	46.8%	1,248	1.2%	19,085	18.8%
9	137	4.5%	1,578	51.3%	1,233	1.2%	20,720	20.4%
10	118	3.8%	1,696	55.1%	1,180	1.2%	22,218	21.9%
11	103	3.3%	1,799	58.5%	1,133	1.1%	23,598	23.2%
12	101	3.3%	1,900	61.8%	1,212	1.2%	24,875	24.5%
13	91	3.0%	1,991	64.7%	1,183	1.2%	26,051	25.7%
14	86	2.8%	2,077	67.5%	1,204	1.2%	27,136	26.7%
15	51	1.7%	2,128	69.2%	765	0.8%	28,135	27.7%
16	48	1.6%	2,176	70.7%	768	0.8%	29,083	28.6%
17	61	2.0%	2,237	72.7%	1,037	1.0%	29,983	29.5%
18	55	1.8%	2,292	74.5%	990	1.0%	30,822	30.4%
19	51	1.7%	2,343	76.2%	969	1.0%	31,606	31.1%
20	39	1.3%	2,382	77.4%	780	0.8%	32,339	31.9%
21	35	1.1%	2,417	78.6%	735	0.7%	33,033	32.5%
22	32	1.0%	2,449	79.6%	704	0.7%	33,692	33.2%
23	26	0.8%	2,475	80.5%	598	0.6%	34,319	33.8%
24	21	0.7%	2,496	81.1%	504	0.5%	34,920	34.4%
25	23	0.7%	2,519	81.9%	575	0.6%	35,500	35.0%
26	23	0.7%	2,542	82.6%	598	0.6%	36,057	35.5%
27	21	0.7%	2,563	83.3%	567	0.6%	36,591	36.0%
28	17	0.6%	2,580	83.9%	476	0.5%	37,104	36.5%
29	13	0.4%	2,593	84.3%	377	0.4%	37,600	37.0%
30	11	0.4%	2,604	84.7%	330	0.3%	38,083	37.5%
31	10	0.3%	2,614	85.0%	310	0.3%	38,555	38.0%
32	18	0.6%	2,632	85.6%	576	0.6%	39,017	38.4%
33	9	0.3%	2,641	85.9%	297	0.3%	39,461	38.9%
34	11	0.4%	2,652	86.2%	374	0.4%	39,896	39.3%
35	7	0.2%	2,659	86.4%	245	0.2%	40,320	39.7%
36	11	0.4%	2,670	86.8%	396	0.4%	40,737	40.1%
37	8	0.3%	2,678	87.1%	296	0.3%	41,143	40.5%
38	8	0.3%	2,686	87.3%	304	0.3%	41,541	40.9%
39	9	0.3%	2,695	87.6%	351	0.3%	41,931	41.3%
40	8	0.3%	2,703	87.9%	320	0.3%	42,312	41.7%
41	8	0.3%	2,711	88.1%	328	0.3%	42,685	42.0%
42	6	0.2%	2,717	88.3%	252	0.2%	43,050	42.4%
43	6	0.2%	2,723	88.5%	258	0.3%	43,409	42.8%
44	4	0.1%	2,727	88.7%	176	0.2%	43,762	43.1%
45	5	0.2%	2,732	88.8%	225	0.2%	44,111	43.4%
46	8	0.3%	2,740	89.1%	368	0.4%	44,455	43.8%
47	9	0.3%	2,749	89.4%	423	0.4%	44,791	44.1%
48	6	0.2%	2,755	89.6%	288	0.3%	45,118	44.4%
49	8	0.3%	2,763	89.8%	392	0.4%	45,439	44.8%
50	4	0.1%	2,767	90.0%	200	0.2%	45,752	45.1%
51-100	117	3.8%	2,884	93.8%	8,362	8.2%	49,164	48.4%
101-200	98	3.2%	2,982	96.9%	13,921	13.7%	60,985	60.1%
201-300	42	1.4%	3,024	98.3%	10,021	9.9%	62,606	61.7%
301-400	15	0.5%	3,039	98.8%	5,120	5.0%	67,726	66.7%
401-500	8	0.3%	3,047	99.1%	3,480	3.4%	71,206	70.1%
500-1000	25	0.8%	3,072	99.9%	16,950	16.7%	88,156	86.8%
>1000	4	0.1%	3,076	100.0%	13,366	13.2%	101,522	100.0%
Total	3,076	100.0%			101,522	100.0%		

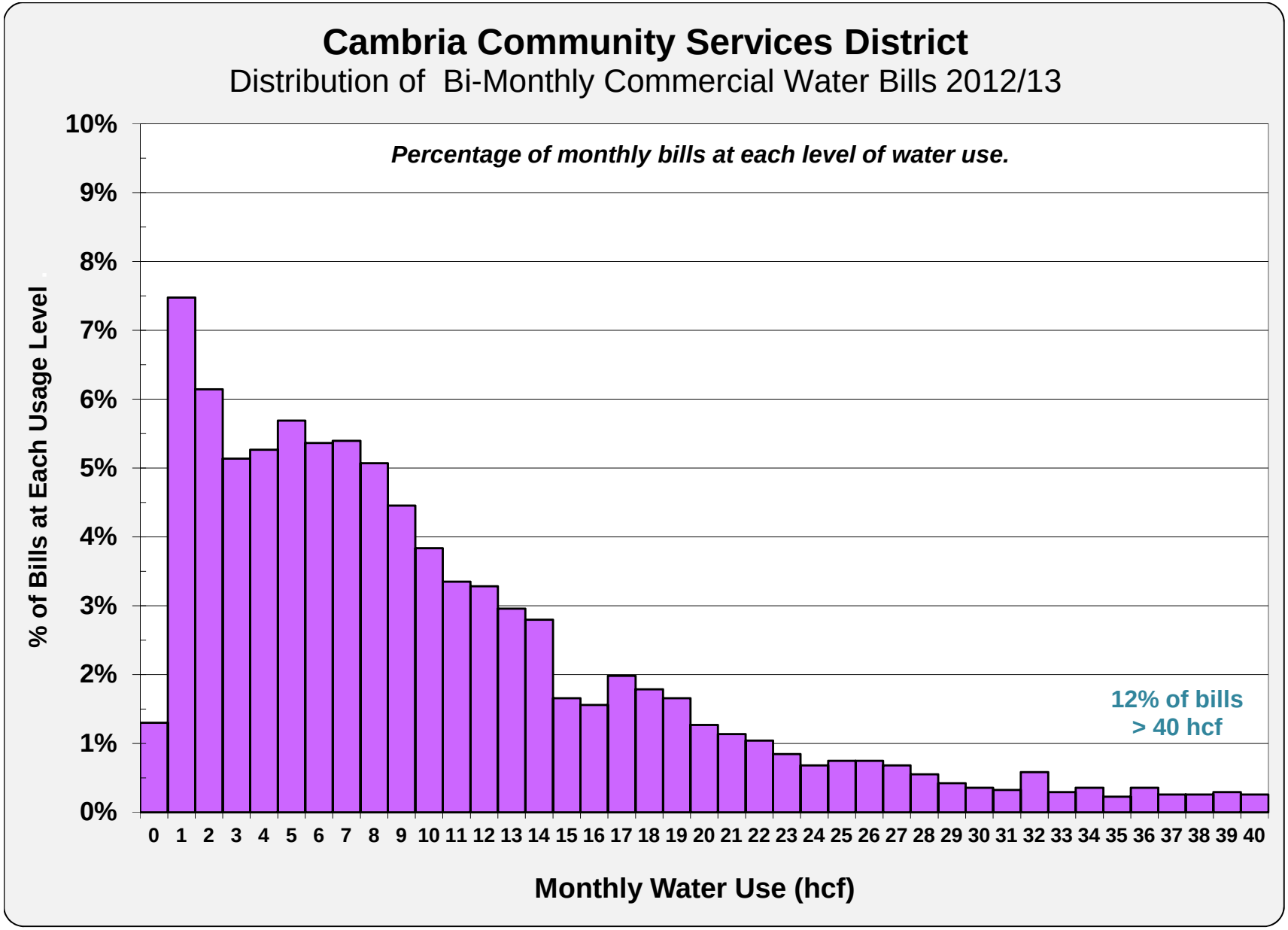
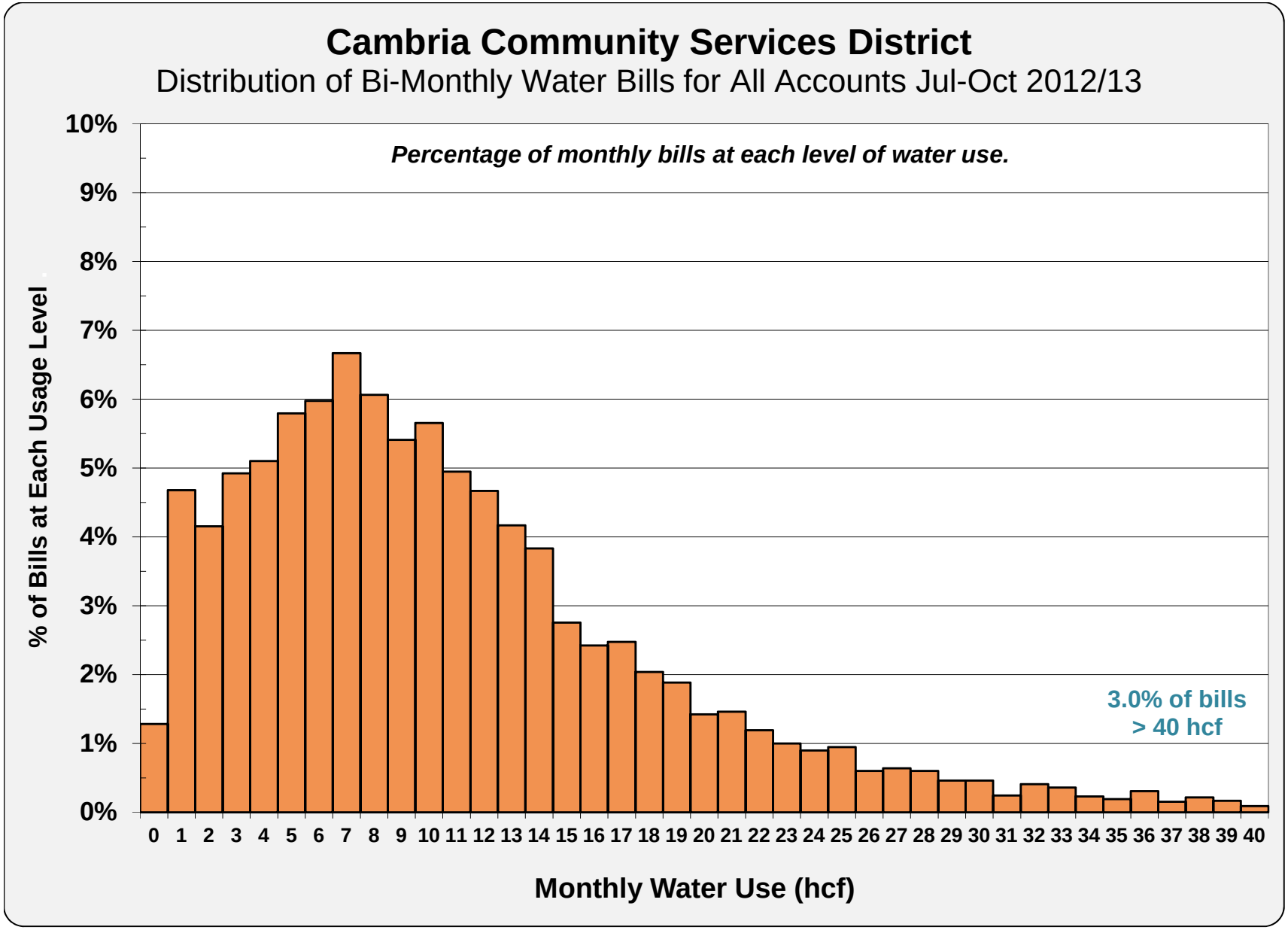

Cambria Community Services District
Distribution of Bi-Monthly Commercial Water Bills 2012/13
Percentage of monthly bills at each level of water use.
% of Bills at Each Usage Level
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
12% of bills
> 40 hcf
Monthly Water Use (hcf)

Table B-4
Cambria Community Services District
Consumption Block Analysis 2012/13 (All Accounts)

All Accounts: July - October Usage
Median Bi-Monthly Use: 9.0 hcf
Average Bi-Monthly Use: 14.5 hcf

Bi-Monthly	Number of Bills				Water Use (hcf)		Use Through Break	
Use (hcf)	In Block	% of Total	Cumulative	Cumulative %	In Block	% of Ttl	Use (hcf)	% of Ttl
0 (est)	100	1.3%	100	1.3%	0	0.0%	0	0.0%
1	365	4.7%	465	6.0%	365	0.3%	7,699	6.8%
2	324	4.2%	789	10.1%	648	0.6%	15,033	13.3%
3	384	4.9%	1,173	15.0%	1,152	1.0%	22,043	19.5%
4	398	5.1%	1,571	20.1%	1,592	1.4%	28,669	25.4%
5	452	5.8%	2,023	25.9%	2,260	2.0%	34,897	30.9%
6	466	6.0%	2,489	31.9%	2,796	2.5%	40,673	36.0%
7	520	6.7%	3,009	38.6%	3,640	3.2%	45,983	40.8%
8	473	6.1%	3,482	44.6%	3,784	3.4%	50,773	45.0%
9	422	5.4%	3,904	50.1%	3,798	3.4%	55,090	48.8%
10	441	5.7%	4,345	55.7%	4,410	3.9%	58,985	52.3%
11	386	4.9%	4,731	60.7%	4,246	3.8%	62,439	55.3%
12	364	4.7%	5,095	65.3%	4,368	3.9%	65,507	58.1%
13	325	4.2%	5,420	69.5%	4,225	3.7%	68,211	60.5%
14	299	3.8%	5,719	73.3%	4,186	3.7%	70,590	62.6%
15	215	2.8%	5,934	76.1%	3,225	2.9%	72,670	64.4%
16	189	2.4%	6,123	78.5%	3,024	2.7%	74,535	66.1%
17	193	2.5%	6,316	81.0%	3,281	2.9%	76,211	67.5%
18	159	2.0%	6,475	83.0%	2,862	2.5%	77,694	68.9%
19	147	1.9%	6,622	84.9%	2,793	2.5%	79,018	70.0%
20	111	1.4%	6,733	86.3%	2,220	2.0%	80,195	71.1%
21	114	1.5%	6,847	87.8%	2,394	2.1%	81,261	72.0%
22	93	1.2%	6,940	89.0%	2,046	1.8%	82,213	72.9%
23	78	1.0%	7,018	90.0%	1,794	1.6%	83,072	73.6%
24	70	0.9%	7,088	90.9%	1,680	1.5%	83,853	74.3%
25	74	0.9%	7,162	91.8%	1,850	1.6%	84,564	75.0%
26	47	0.6%	7,209	92.4%	1,222	1.1%	85,201	75.5%
27	50	0.6%	7,259	93.1%	1,350	1.2%	85,791	76.0%
28	47	0.6%	7,306	93.7%	1,316	1.2%	86,331	76.5%
29	36	0.5%	7,342	94.1%	1,044	0.9%	86,824	77.0%
30	36	0.5%	7,378	94.6%	1,080	1.0%	87,281	77.4%
31	19	0.2%	7,397	94.8%	589	0.5%	87,702	77.7%
32	32	0.4%	7,429	95.3%	1,024	0.9%	88,104	78.1%
33	28	0.4%	7,457	95.6%	924	0.8%	88,474	78.4%
34	18	0.2%	7,475	95.8%	612	0.5%	88,816	78.7%
35	15	0.2%	7,490	96.0%	525	0.5%	89,140	79.0%
36	24	0.3%	7,514	96.3%	864	0.8%	89,449	79.3%
37	12	0.2%	7,526	96.5%	444	0.4%	89,734	79.5%
38	17	0.2%	7,543	96.7%	646	0.6%	90,007	79.8%
39	13	0.2%	7,556	96.9%	507	0.4%	90,263	80.0%
40	7	0.1%	7,563	97.0%	280	0.2%	90,506	80.2%
41	9	0.1%	7,572	97.1%	369	0.3%	90,742	80.4%
42	5	0.1%	7,577	97.2%	210	0.2%	90,969	80.6%
43	8	0.1%	7,585	97.3%	344	0.3%	91,191	80.8%
44	10	0.1%	7,595	97.4%	440	0.4%	91,405	81.0%
45	3	0.0%	7,598	97.4%	135	0.1%	91,609	81.2%
46	12	0.2%	7,610	97.6%	552	0.5%	91,810	81.4%
47	7	0.1%	7,617	97.7%	329	0.3%	91,999	81.5%
48	3	0.0%	7,620	97.7%	144	0.1%	92,181	81.7%
49	6	0.1%	7,626	97.8%	294	0.3%	92,360	81.9%
50	3	0.0%	7,629	97.8%	150	0.1%	92,533	82.0%
51-100	92	1.2%	7,721	99.0%	6,131	5.4%	97,964	86.8%
101-200	35	0.4%	7,756	99.4%	4,958	4.4%	103,722	91.9%
201-300	21	0.3%	7,777	99.7%	5,072	4.5%	106,794	94.7%
301-400	7	0.1%	7,784	99.8%	2,352	2.1%	108,546	96.2%
401-500	2	0.0%	7,786	99.8%	861	0.8%	109,907	97.4%
500-1000	12	0.2%	7,798	100.0%	8,362	7.4%	112,769	100.0%
>1000	1	0.0%	7,799	100.0%	1,056	0.9%	112,825	100.0%
Total	7,799	100.0%			112,825	100.0%		
% of Annual	33.7%				37.3%			


Cambria Community Services District
Distribution of Bi-Monthly Water Bills for All Accounts Jul-Oct 2012/13
Percentage of monthly bills at each level of water use.
% of Bills at Each Usage Level
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
3.0% of bills
> 40 hcf
Monthly Water Use (hcf)

APPENDIX 3-4A – SSCSD GROUNDWATER AVAILABILITY 1986 STUDY

CLEATH

SAN SIMEON ACRES COMMUNITY SERVICES DISTRICT

GROUND WATER AVAILABILITY PICO CREEK GROUND WATER BASIN

MARCH 1986

TIMOTHY S. CLEATH

CEG 1102

Timothy S. Cleath
CEG 1102
Timothy S. Cleath
Engineering Geologist
Ground Water
(805) 543-1413
1390 Oceanaire Drive
San Luis Obispo
California 93401

March 21, 1986

Board of Directors
San Simeon Acres Community Services District
Rt. 1 Box S-17
San Simeon, CA 93452

Attention: Mr. Lonnie Price, President

Dear Sir:

I am pleased to submit this report in fulfillment of the requirements of our contract for a "Ground Water Availability Study, Pico Creek Ground Water Basin," authorized on August 22, 1985. The scope of this study has been performed in two phases: Phase I, Historic Ground Water Availability, and Phase II, Future Ground Water Availability. This report is organized into two parts, reflecting the scope approach and objectives of the contract.

The project has been accomplished with the assistance and cooperation of the Board members, District personnel, and the District Engineer, Mr. John McWherter. Mr. Jack Cooke, Mr. Harlan Brown, and Mr. Dick Skinner of the Hearst Corporation have provided permission for access and drilling in the Pico Creek valley. Team members brought together to perform integral parts of this investigation include:

Surface Water Simulation: Mr. Douglas Hahn
James M. Montgomery, Consulting Engineers, Inc.

Exploratory Drilling: Pacific Geoscience

Ground Water Modeling: Mr. Michael Powers

Wastewater Reclamation Alternatives: Mr. John L. Wallace
John L. Wallace & Associates

I am grateful for the opportunity to provide the District with this product and appreciate the assistance and input I have received during the course of the investigation.

If I can provide additional services to the District or should there be any questions concerning this report, please contact me.

Sincerely,

Timothy S. Cleath
CEG 1102

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PART I

HISTORIC
GROUND WATER AVAILABILITY

INTRODUCTION

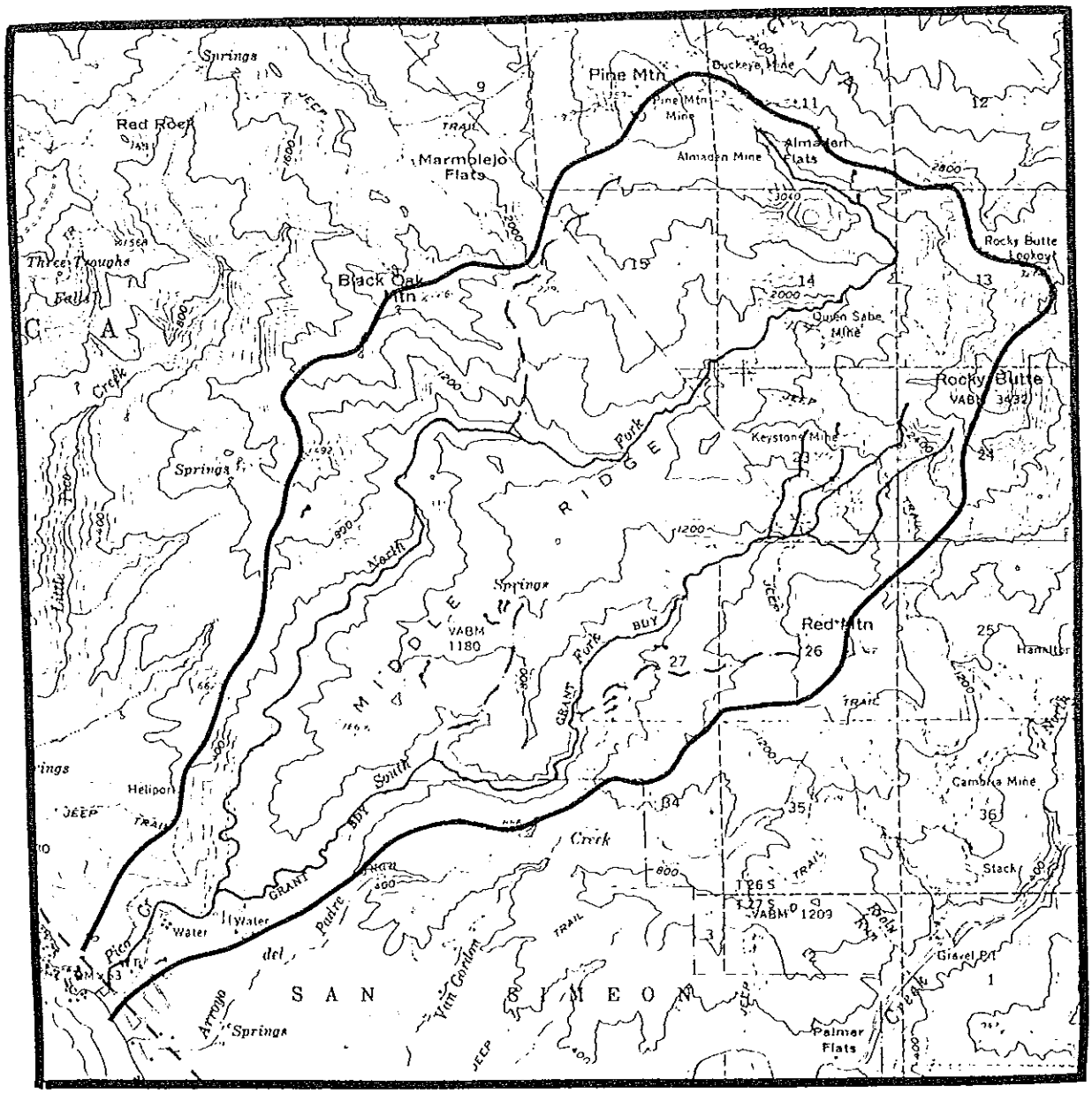
The first phase of this ground water study was conducted to address the District's concern over recent events when ground water levels have declined and certain water quality constituents have been found at elevated concentrations. The cause of these recent events was ascertained based upon an investigation of the Pico Creek ground water basin which included a simulation of Pico Creek flow, an exploratory drilling program to define the configuration of the ground water basin, and a compilation and analysis of ground water levels, quality, and production records.

The findings of this investigation are summarized in Part I of this report. Part I addresses the Pico Creek valley hydrology, hydrogeology, water quality, and water production, and presents the evidence indicating that sea water intrusion appears to be the cause of recent events.

STUDY AREA

San Simeon Acres Community Services District obtains water from wells in Pico Creek valley. Although Pico Creek drains a watershed area of about fourteen square miles, the portion of this area comprising the ground water basin is only about one-tenth of a square mile (Figure 1 and photographs). The ground water basin is located within 7,000 feet of the coastline under the creekbed and floodplain of Pico Creek. The portion of the basin within 1200 feet of the beach is undeveloped. From 1200 feet inland of the coast to 4000 feet inland of the coast, the Hearst horse stables and pasture are located. Further inland, the area is used to graze cattle. The basin area ranges in elevation from near sea level at the coast to about 40 feet above sea level at the confluence of the north and south tributaries of Pico Creek. Topographic control in the area is limited to only a few locations: the District's wells are at elevations of between 15 and 16 feet and the ranch bridge crossing Pico Creek has a bench mark on the top of the bridge's side wall of 31 feet.

Other features of the study area include two perennial water bodies: a pond about 500 feet from the coast and a coastal lagoon. The lagoon is fed by sea water breaching the beach berm at its mouth during very high tides and by Pico Creek, when it flows. The lagoon extends about 1100 feet inland of the coast. The pond, said to have formerly been a gravel quarry, is comprised of a perennially wet area and an area which is only wet during the winter when ground water levels are high. The perennially wet pond area is about 200 feet square and the intermittently wet pond area, located closer to the southern wall of the valley, is about 100 feet long and 200 feet wide.



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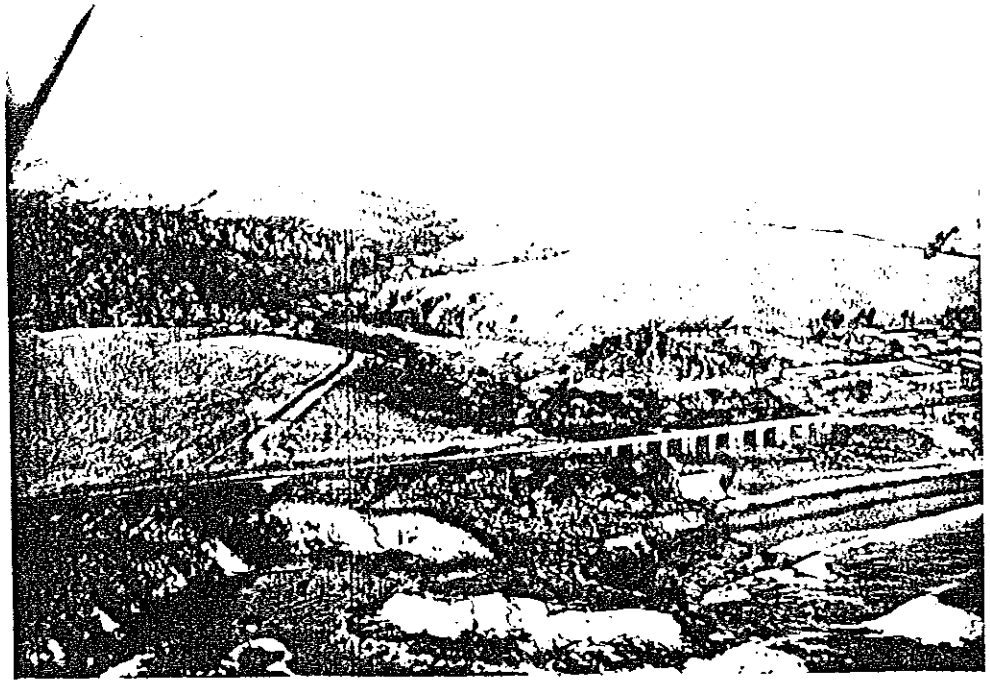
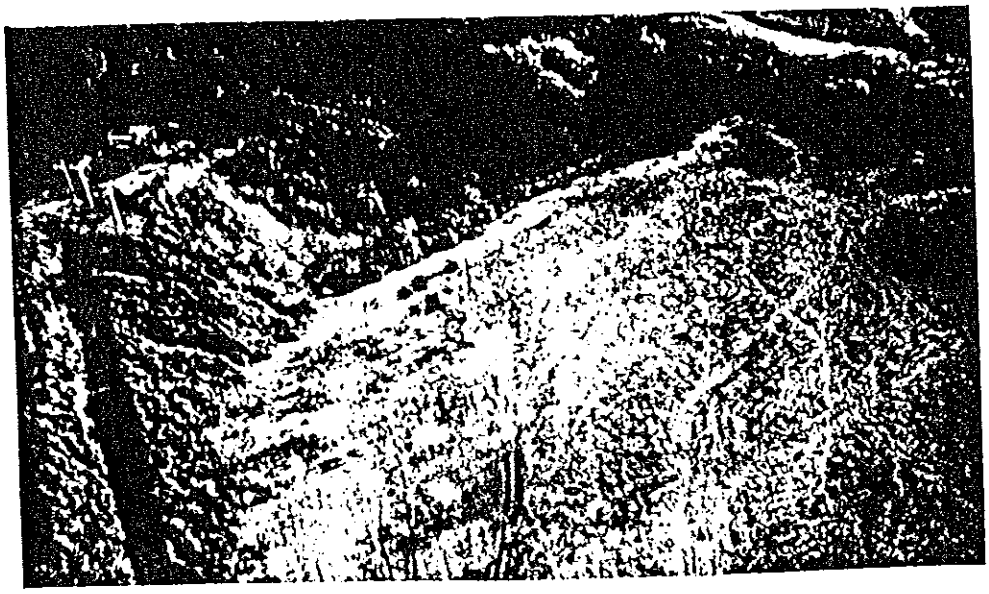
SCALE 1:62500

PICO CREEK WATERSHED,
SAN SIMEON ACRES CSD

FIGURE 1

TIMOTHY S. CLEATH
CEG 1102





CLIMATE AND HYDROLOGY

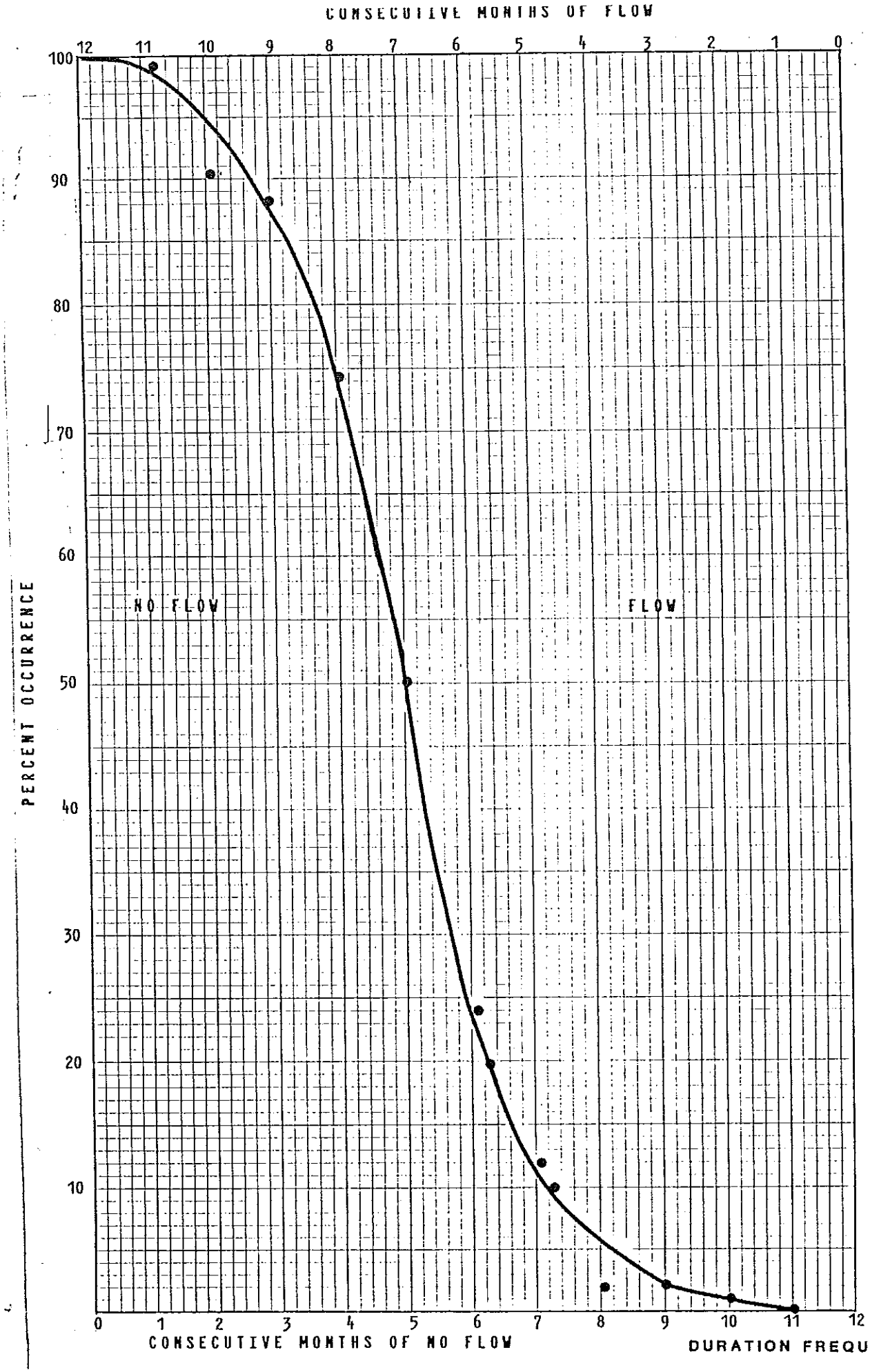
The climate and hydrology in the Pico Creek watershed are primary ingredients which influence the availability of water to the District's two wells in Pico Creek valley. Records of rainfall in the watershed area and Pico Creek flow have not been kept; therefore, a simulation of these records was generated for this study based on correlations of watershed area, mean annual precipitation, and runoff characteristics between Pico Creek watershed and adjacent watersheds for which records were available. A statistical computer program (HEC-4) from the U.S. Army Corp of Engineers was used to prepare this simulation.

The objective of this simulation was to determine the duration and frequency of no flow conditions in the creek. It is during these periods of no flow when the ground water stored in the alluvium and the subsurface flow from upstream are the only significant sources of recharge ro the District's wells. When the creek is flowing, adequate water supply is available from the District's wells to provide for the maximum demands of the system because the creek flow directly recharges the ground water basin and is in excess of this demand.

A description of the hydrologic analysis is included in the appendix and a copy of the computer printout is available upon request. The results are summarized in the following paragraphs and Figures 2 and 3.

This simulation indicates that each year can be divided into one period of creek flow and one period of no creek flow. The period of creek flow is typically during the winter months, while the period of no creek flow is during the summer months. Figure 2 illustrates the percent occurrence of consecutive months of flow and no flow per year for 100 years of simulated record. Figure 3 provides a different perspective on the percent of years during which no creek flow occurs for different time lengths. It appears that a seven month or less duration of no creek flow would occur 90 percent of the time, an eight month or less duration of no creek flow would occur 95 percent of the time, and a nine month or less duration of no creek flow would occur 98 percent of the time.

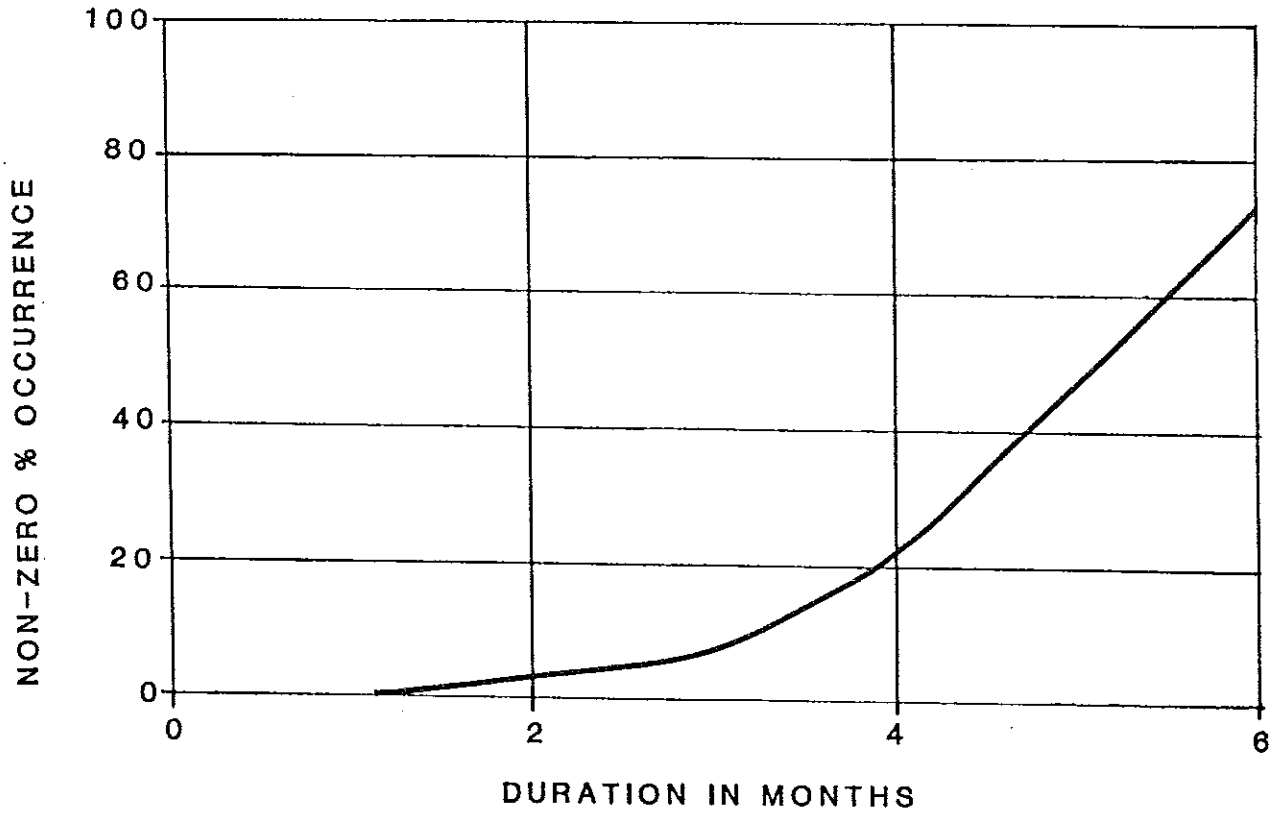
Since the beginning of this study, August 22, 1985, various climatic and creek flow conditions have been observed. The creek bed was dry upstream of the beach lagoon from the beginning of the study until about November 10. Following early season rains, creek flow estimated at three cubic feet per second (cfs) with minimal turbidity was observed (December 10, 1985). The beach berm was intact when flow diminished later and surf was high. Following a week of heavy rainfall totaling more than 10 inches (February 16, 1986), creek flow was observed which was turbid and had breached the beach berm. Flow could have been more than 30 cfs when observed and was probably much higher during the storm. No evidence of flooding near the wells was observed.



DURATION FREQUENCY CURVE
PICO CREEK
SAN SIMEON ACRES CSD

TIMOTHY S. CLEATH
CEG 1102

FIGURE 2



FREQUENCY-DURATION
CURVE FOR ZERO FLOW
PICO CREEK
SAN SIMEON ACRES CSD

FIGURE 3

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Aerial photographs taken on September 18, 1985 show that the beach lagoon extends about 1100 feet inland from the ocean during periods of no creek flow. Two depressions are adjacent to the lagoon. The main depression is totally separated from the lagoon and was found to contain water even when no creek flow is occurring. Another depression south of the wet depression was dry at this time, but wet during the following winter. These topographic depressions were not fed by the creek even during the rains of February 1986. Instead these depressions are fed by and are in hydraulic continuity with ground water and precipitation. The depth of the deeper depression is not known, but it is not expected to be more than a few feet deep.

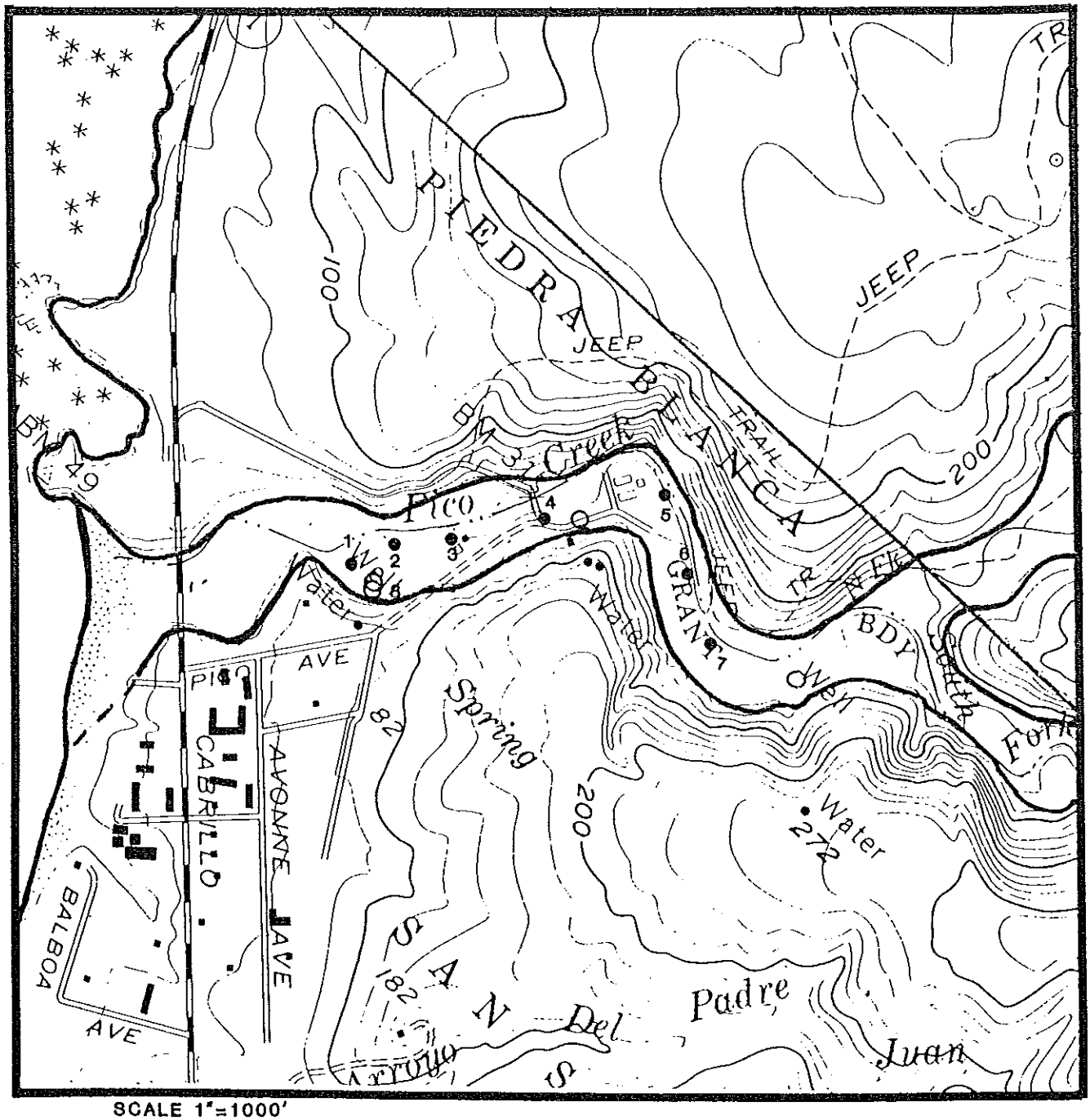
HYDROGEOLOGY

The study area within the District boundaries and the adjacent Hearst Ranch includes two distinct hydrogeologic units: (1) Pico Creek valley alluvium and (2) marine terraces underlain by metamorphic rock. The Pico Creek alluvium unit is water bearing and extends from the coast more than 7000 feet upstream under the floodplain of Pico Creek. The marine terrace unit is typically non-water bearing and underlies San Simeon Acres and the Hearst Ranch areas south and east of the District as well as north of Pico Creek valley. Because the Pico Creek alluvium is the only source of water for the District and because it has such an important part in this study, the description of the hydrogeology of the study area is limited to this unit.

AQUIFER DESCRIPTION

The Pico Creek alluvium consists of deposits of sands, gravels, silt, and clay with a maximum thickness of about 60 feet and thinning to a feather edge on the north and south sides of the valley and upstream. Eight borings were drilled to provide information in addition to the existing two well logs for the District's wells. Figure 4 shows the boring locations. The descriptive logs are included in the appendix. These borings were drilled with the approval of the Hearst Corporation.

The borings were drilled only in the vicinity of, and upstream of, the District's wells. The base of the water bearing alluvium was determined for this area based upon this drilling. The deepest part of the alluvium was not found to coincide with the axis of the valley, but instead was found to vary in location based upon prehistoric water courses cut into the bedrock below the now existent alluvial fill. The base of the alluvium was found to be at progressively higher elevations in the upstream borings. In borings 6 and 7, the base of the alluvium was encountered at or near sea level. This is significant to note because sea water intrusion could not progress inland from where the base of the alluvium is at sea level, between borings 5 and 6. Figure 5 is a contour of the elevation of the base of the alluvium, based upon the borings and well logs.



O EXISTING WELL

● BORING

BORING LOCATIONS
EXPLORATORY PROGRAM
PICO CREEK VALLEY
SAN SIMEON ACRES C.S.D.

TIMOTHY S. CLEATH
CEG 1102

FIGURE 4

The alluvium has been deposited with a clayey gravel at its base overlain by sand and gravel interbedded with one distinct clay zone. Figure 6 presents a hydrogeologic profile up the valley illustrating this stratification. The clay zone was not encountered in the borings drilled upstream of the stables. The water producing zones within the alluvium are the saturated sands and gravels. The alluvium downstream of the stables has a shallow and a deep aquifer separated by a clay zone which acts as an aquitard. This clay zone appears to extend over much of the lower pasture except in some areas near the creek (such as the boring 2 location) where it appears that it has been eroded away and replaced with coarse gravels.

The shallow aquifer underlying the lower pasture area is present from below the soil mantle to the clay zone. The saturated thickness of this aquifer varies during the course of the year and can be segregated into two layers: above sea level and below sea level. The saturated thickness of the shallow aquifer above sea level ranges from zero feet near the end of the dry season to six feet when the creek is flowing. The shallow aquifer below sea level is continuously saturated and has a thickness which increases from one foot at boring 4 to 21 feet at boring 1.

The deep aquifer underlying the lower pasture was encountered in borings 1,3 and 4. This aquifer of gravel and sand is constantly saturated and was found to have a uniform thickness of 19 feet. At boring 5 upstream, this deep aquifer appears to combine with the shallow aquifer as a single aquifer, because the clay zone is absent.

The area upstream of the stables has only one aquifer which is, in large part, above sea level. The portion of this upstream aquifer which is saturated is not well documented, but is known to vary considerably from winter to fall. One measurement taken when the creek was flowing at the upper Hearst Ranch well (with a surface elevation of roughly 36 feet) was a depth to water of about 15 feet. The pump in this same well was lowered during the summer in the past year to maintain water production. The pump setting is not known, however.

AQUIFER CHARACTERISTICS

The storage of ground water in the aquifer, and the flow of water in an unconfined aquifer are influenced by the aquifer characteristics: specific yield and permeability. The specific yield is the percent of produceable water for a unit volume of the aquifer. Typically, a clay would have a specific yield of one percent and gravel would have a specific yield of 21 percent. The permeability of the aquifer materials is the rate of flow of ground water which occurs under a unit hydraulic gradient. Typically, a clay bed would have a permeability of one to ten gallons per day per foot^2 (gpd/ft^2), while a gravel bed could have a permeabilty of more than 1,000 gpd/ft^2.

The drilling logs show the basin to be comprised of two zones of coarse sand and gravel with a thickness of about 45 feet and one zone of clay about 10 feet thick. Using the previously used values, an average specific yield for the basin materials would be about 17 percent.

The permeability was determined based upon pumping tests at the District's two wells. The results showed a permeability of about 3000 gpd/ft^2. When the creek is flowing, both wells, when operating, reach a stable pumping level within five minutes (Figures 7 and 8), reflecting the direct recharge which occurs from the creek and the ineffectiveness of the clay layers as a barrier to leakage of ground water from the upper to the lower aquifer zone.

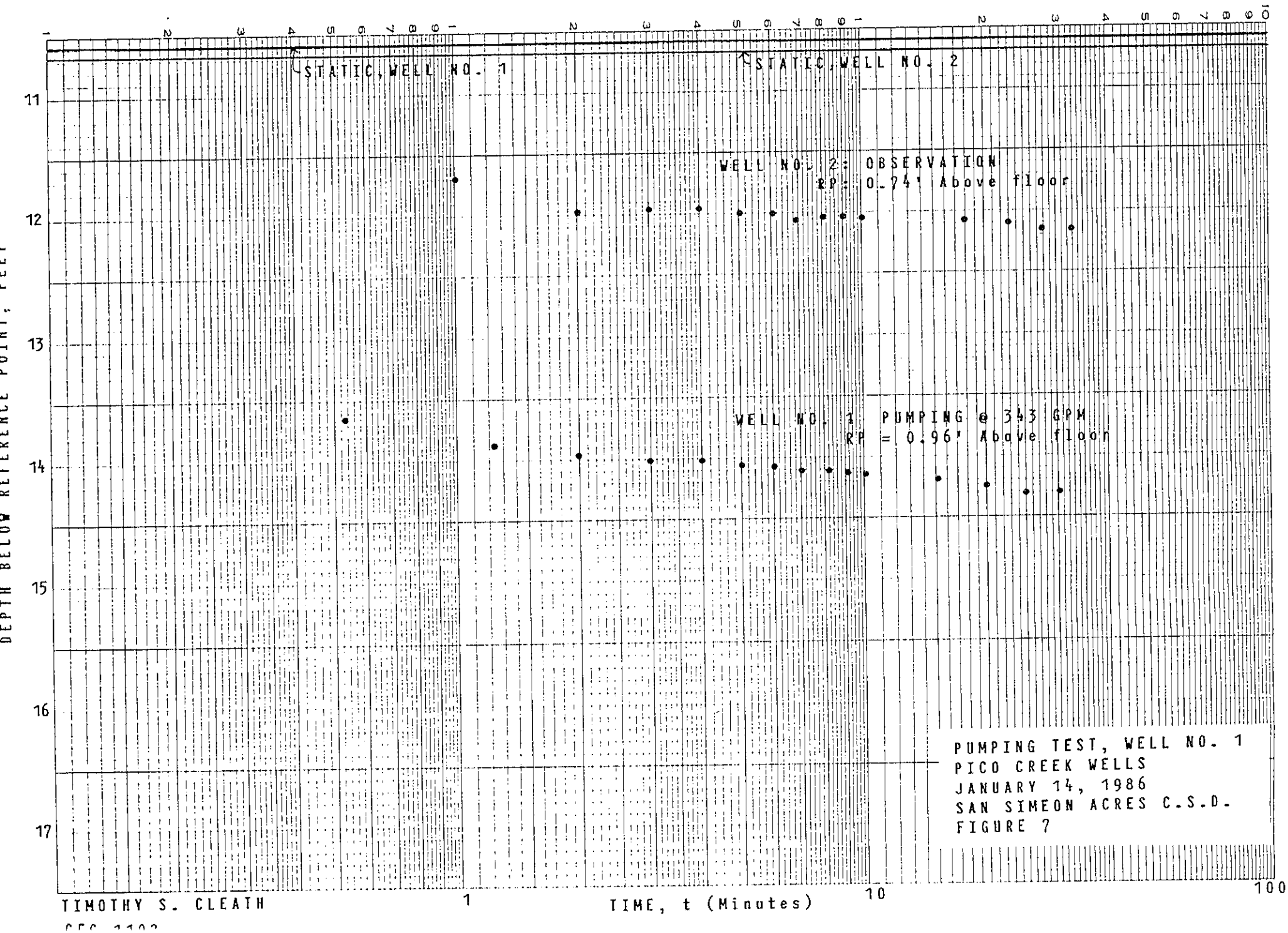
GROUND WATER OCCURRENCE AND MOVEMENT

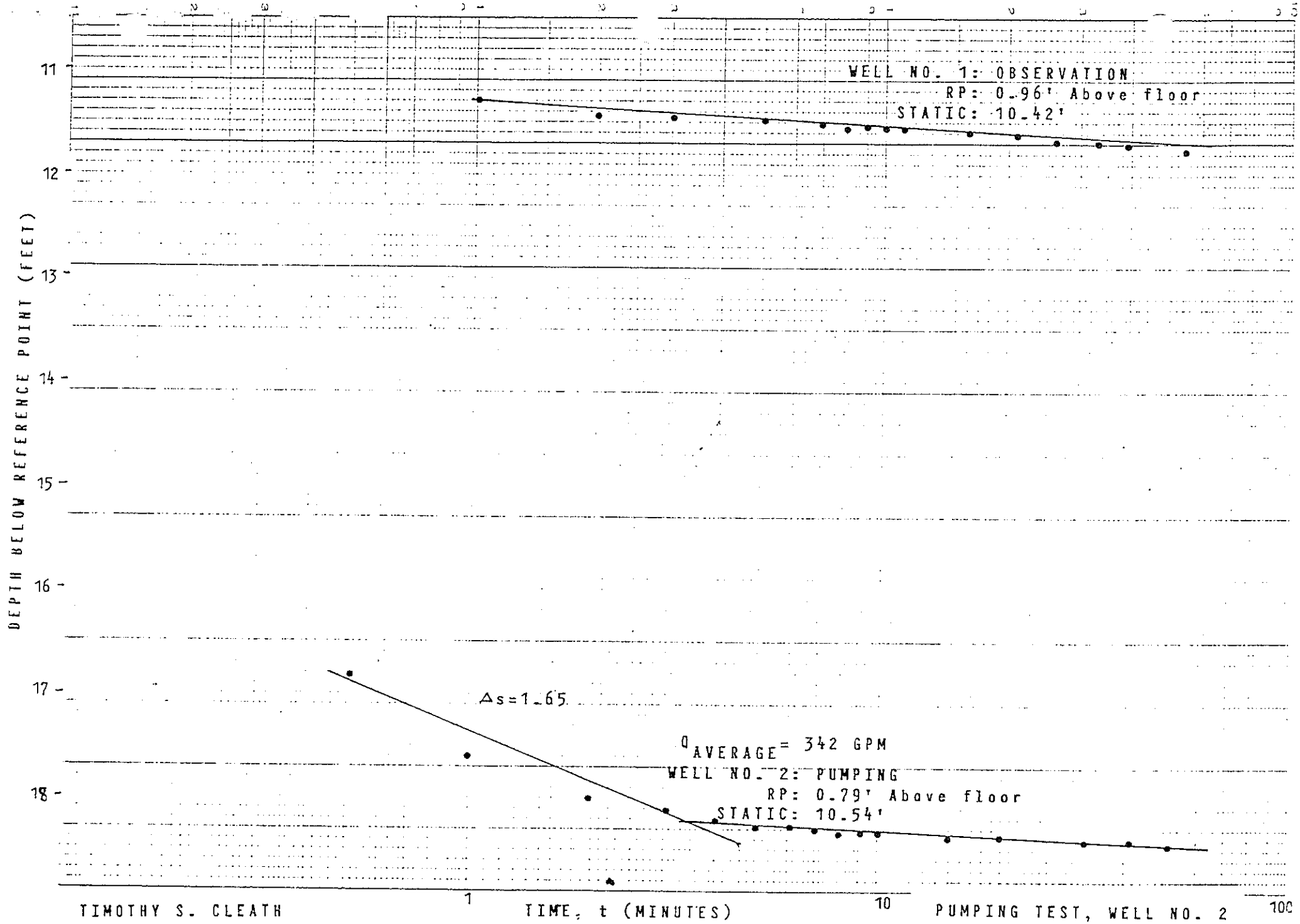
Ground water in the Pico Creek alluvial basin is recharged to, stored within, and flows through the interstices of the coarse sediments. An analysis of the ground water levels measured in the District's wells provides some insight into the influence of recharge from the creek, subsurface inflow from upstream, and the dynamic fresh water/sea water basin boundary on ground water stored in the basin. The limited water level information in the basin, restricted to these two wells, however, requires that assumptions must be made regarding ground water storage estimates and flow gradients upstream of these wells.

Figure 9 presents the general pattern of historic water level fluctuations, while more detailed measurements, begun in 1978 (Figure 10), provide a more complete basis on which ground water occurrence and movement in Pico Creek basin can be analyzed. The historic hydrograph probably does not show the highest annual water levels as they occur in January through March and the measurement was taken in April. The late October measurements generally show the lowest water levels over the past 25 years.

Ground water levels fluctuate in the District wells over the same range, therefore, the hydrograph for Well No. 1 is the only one shown. Typically, the highest water levels are between six and eight feet above sea level, while the lowest water levels are between elevations of one foot below sea level and three feet above sea level.

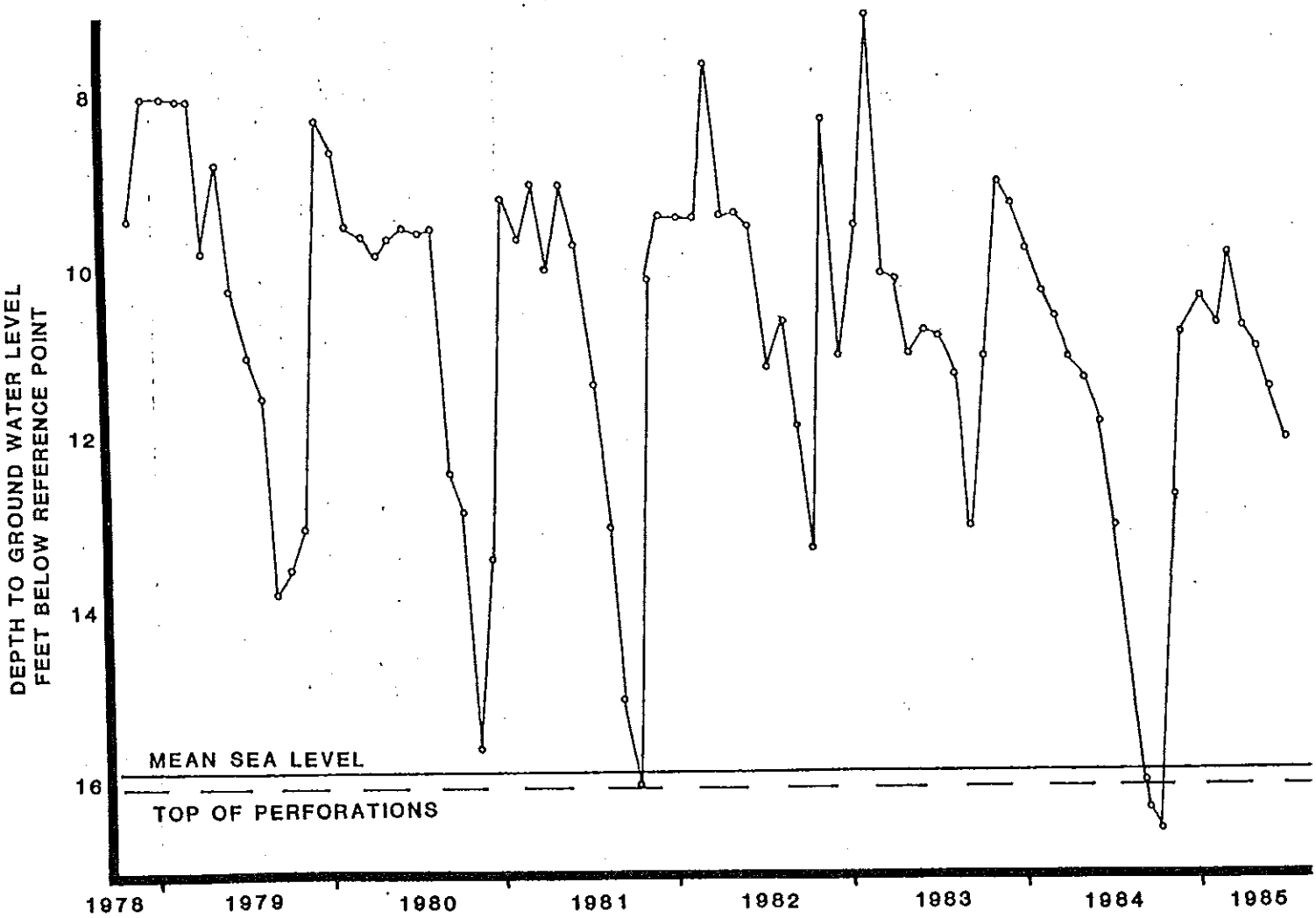
Ground water levels have been below sea level only during three years: 1981, 1984, and 1985 (Figure 10) and on only three other occasions were they less than one foot above sea level: 1976,1977, and 1980. Coincidentally, these six years had below average precipitation, while the intervening years (1978, 1979, 1982, and 1983) had above average precipitation. The duration of below sea level water levels is also reflective of the amount of precipitation: in 1981 when precipitation was 75 percent of average, one month's measurement was below sea level; in 1984 and 1985 when precipitation was 72.1 and 72.5 percent of normal, the duration was three months and two months respectively.


NO. 310 SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH
STATIC, WELL NO. 1
STATIC, WELL NO. 2
WELL NO. 2: OBSERVATION
RP: 0.74' Above floor
WELL NO. 1 PUMPING @ 343 GPM
RP = 0.96' Above floor
DEPTH BELOW REFERENCE POINT, FEET
11
12
13
14
15
16
17
TIME, t (Minutes)
1
10
100
PUMPING TEST, WELL NO. 1
PICO CREEK WELLS
JANUARY 14, 1986
SAN SIMEON ACRES C.S.D.
FIGURE 7
TIMOTHY S. CLEATH



TIMOTHY S. CLEATH
CEG 1102

PUMPING TEST, WELL NO. 2
PICO CREEK WELLS
JANUARY 14, 1986
SAN SIMEON ACRES C.S.D.
FIGURE 8



RECENT HYDROGRAPH
WELL NO. 1
SAN SIMEON ACRES CSD
FIGURE 10

TIMOTHY S. CLEATH
CEG 1102

Precipitation does not appear to be a major source of direct recharge to the basin despite this close correlation between annual low water levels and low precipitation. Instead, it is creek flow that results from precipitation which appears to be the major source of inflow to the basin. This is evidenced by the quick response of ground water levels to the start of creek flow. This occurs after the dry season each year when the water levels rise as much as six feet in less than a month. Drilling confirmed the presence of highly permeable sands and gravels connecting the creek with underlying aquifers, facilitating this direct recharge, whereas the floodplains are underlain by a clayey soil mantle which inhibit percolation of precipitation.

During the months of no creek flow, the hydrograph shows a continuous decline of the water level. The water level decline is steep when above sea level, and is much less once below sea level. The steep segment of the water level decline reflects the dewatering of the aquifer above sea level. This is due to the effect of insufficient subsurface inflow to counteract subsurface outflow to the ocean and pumpage of wells owned by the District and the Hearst Corporation. Once the ground water in storage above sea level has been depleted, subsurface outflow is not significant and subsurface inflow has probably diminished to an insignificant rate as well. Then, pumpage by the wells when water levels are at sea level or below results in the landward and inland migration of the fresh water/sea water interface.

The landward migration of the interface allows the extraction of fresh water stored in coastal portions of the basin. Once the interface reaches the pumping wells, the quality of the water produced is diminished. At the point in time when the degraded quality is not acceptable to San Simeon Acres C.S.D., the available fresh water in storage downstream will have been depleted. This has not occurred to date, but the quality of water has diminished during periods of low water levels.

The location of this interface has not been known until recent years when the quality of water produced by the District suggested that the "toe" of the interface had reached the District's wells. Conductivity measurements taken at the beach lagoon and the adjacent pond prior to the start of creek flow in November 1985 indicated that the "tip" of the interface was several hundred feet inland of the coast.

In the 1930's a well was constructed in the vicinity of the Highway 1 bridge. It probably produced fresh water. This well has not been located. The use of this well for fresh water probably places the fresh water/ sea water interface at the coast.

The position of this interface, which is pulled inland during the dry season, is pushed towards the coast when ground water levels are above sea level. If the interface has not been pushed all the way back to its

original location, the next year's dry season extractions will allow the interface to move further inland. This along with higher extractions may be the reason why, despite having slightly higher water levels for a shorter period, the quality of water was poorer in 1985 than in 1984.

STORAGE AND YIELD

Ground water in storage in Pico Creek basin includes two components: ground water stored above sea level and ground water stored below sea level. Most of the water stored above sea level is available to production wells on an annual basis, while the available water stored below sea level is only a small percentage of the total water stored below sea level.

The quantity of water stored above sea level is a function of the specific yield, basin area, and the ground water surface elevation. The average specific yield above sea level is about 17 percent because of the presence of sands, coarse gravels and cobbles. The sands and gravels have a specific yield of 21 percent and the cobble bed is estimated to have a specific yield of 14 percent. The basin area is 62.5 acres from the beach lagoon to the confluence of the two tributaries upstream. When the basin is full, the average ground water level is about 6 feet above sea level. These factors result in an above sea level storage estimate of 64 acre-feet.

Based upon the 1961 water level fluctuation in the District wells, about 10 acre-feet of water in storage drains to the ocean. An additional amount consumed by vegetation and evaporation is about 15 acre-feet. The available ground water in storage above sea level would then be about 40 acre-feet. This could vary with the water level. Each foot of storage basinwide is equivalent to about 10 acre-feet.

Ground water in storage below sea level may be calculated using the basin bottom configuration (Figure 6), the average specific yield, and the seaward edge of the basin. Assuming the beach to be the seaward edge of the basin, 150 acre-feet of water is stored below sea level. Of this amount, about 90 acre-feet of water is stored between the coast and the District's wells. Much of the ground water basin seaward of the wells has already been invaded by sea water. As a result, only a small percentage of the ground water stored in this area is available for extraction from wells. Based upon the three years 1980, 1984, and 1985, extractions of less than 10 acre-feet during the time when water levels were below one foot above sea level resulted in increased salinity in the produced water. In 1985, extractions of about 50 acre-feet during the low water level months resulted in significant rises in salinity. Available ground water in storage below sea level will vary from year to year, but is less than 50 acre-feet on the average.

The ground water basin yield is a combination of (1) Pico Creek recharge, (2) subsurface inflow less outflow, (3) extractions of ground water stored above sea level, and (4) sub-sea level fresh water/sea water interface migration. During the year, the first two items are key basin yield components in the late fall, winter and spring and the last two items are key components in the summer and early fall. In the late fall, winter, and spring, when the creek flows, typically for about 5 months, the flow rate commonly exceeds one cfs. With this source of recharge available, the existing and potential requirements of the District and the Hearst horse ranch can be met. After the creek stops flowing, subsurface inflow remains which contributes diminishing flow over the next few months. Over the last few months prior to resumption of creek flow, ground water in storage is relied upon for basin yield. With the District's fluctuating demand requirements and in light of the detrimental impacts of the past two years, the basin yield, using existing facilities, should be about 120 acre-feet per year.

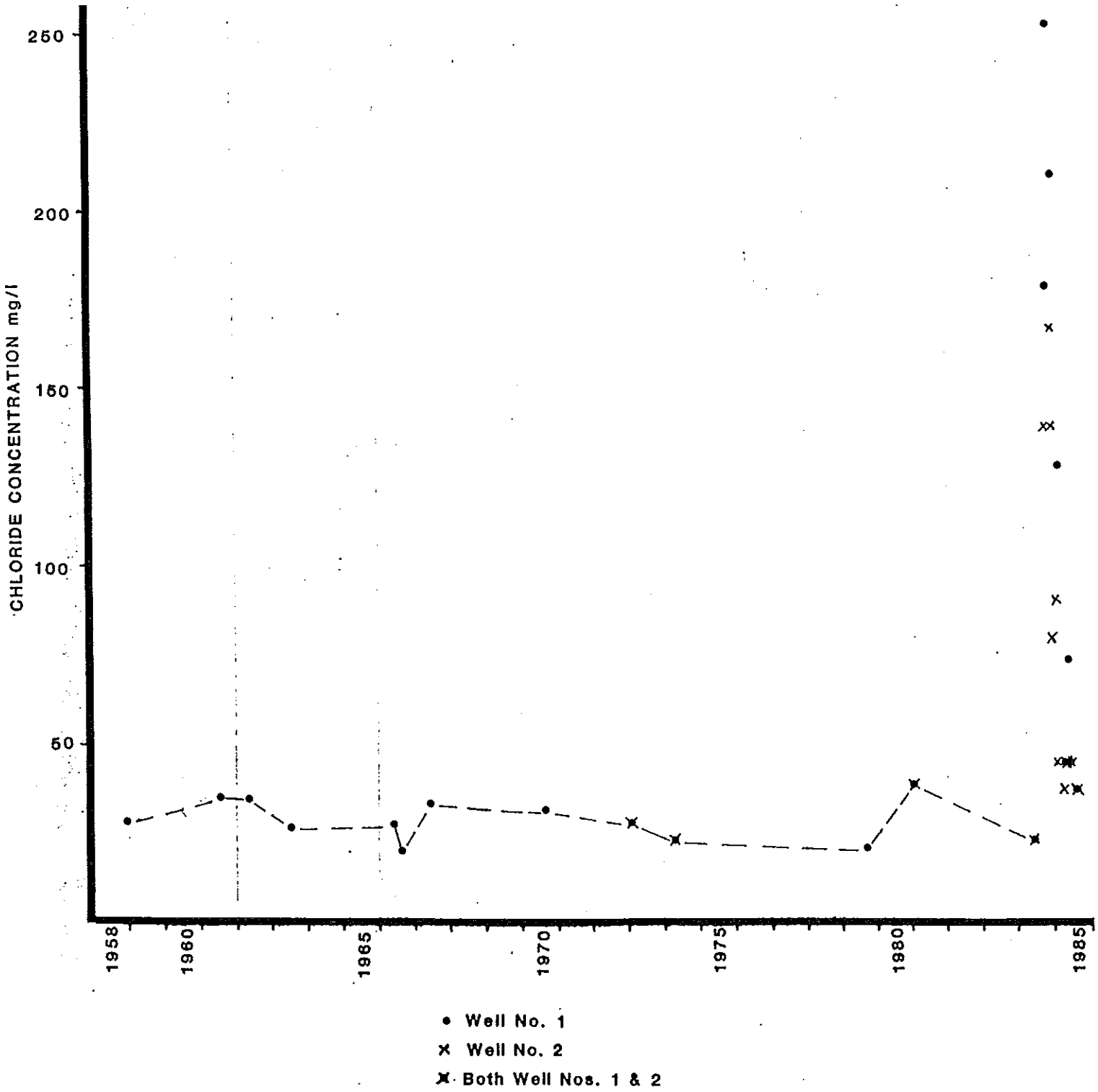
WATER QUALITY

Ground water quality, for the purposes of the initial proposal was to be studied to determine the cause of the increased salinity noted in November and December 1984. During the course of this study, another period of increased salinity was noted for October to December 1985. Proposed causes included backflow of water softeners in the system, local contamination in the ground water basin, and sea water intrusion. A letter report submitted by Central Coast Analytical Services, Inc. on January 1985 concluded "that sea water intrusion is not to be blamed for the decline in water quality seen in the samples submitted by the motels." and that the poorer water quality could be explained as being from "deeper ground water of poorer quality."

Several evidences exist that lead to the conclusion that this ground water of poorer quality is a manifestation of sea water intrusion. The evidences result from a review of historic general mineral quality and chloride concentrations, correlations with ground water levels, and deep ground water sampling.

Historic general mineral analytic reports were collected and the character of the water from each analysis all had similar proportions of each mineral except for those samples collected in January 1981 and December 1984. These analyses, when plotted on a graph (Figure 11) commonly used to compare the similarity of multiple analyses, did not fall within the same area as the other analyses. The notable differences are shown in the anion category. Clearly, there was a higher proportion of chloride in these waters. Other minerals did not vary as significantly as did the chlorides.

The pre-1980 chloride analyses indicate that the chloride concentrations vary from 20 mg/l to 30 mg/l, but the January 1981 sample reached 39 mg/l (Figure 12). The following year, no analysis was performed to check the possibility of increased salinity.



CHLORIDE CONCENTRATION
SAN SIMEON ACRES CSD

TIMOTHY S. CLEATH
CEG 1102

FIGURE 12

The 1984 event was monitored much more closely following consumer complaints about salinity. The trend of these chloride concentrations following the complaint (Figure 13) show an initial increase followed by a gradual reduction in chloride concentrations over the ensuing four months to a level below 45 mg/l.

The maximum chloride concentration was consistently higher in Well No. 1 than in Well No. 2 until a normal level was once again reached in both wells during April. Well No. 1 is a shallower well (47 feet deep) than Well No. 2 (60 feet deep); therefore, the deeper aquifer actually contained better quality water than the shallow aquifer when water levels were low. Water samples collected during exploratory drilling for this project also resulted in this observation. The clay bed encountered in the exploratory borings may be the reason for the difference in water quality between the two wells. The sea water intrusion may be more notable in the shallow aquifer above the clay aquitard than in the deep aquifer.

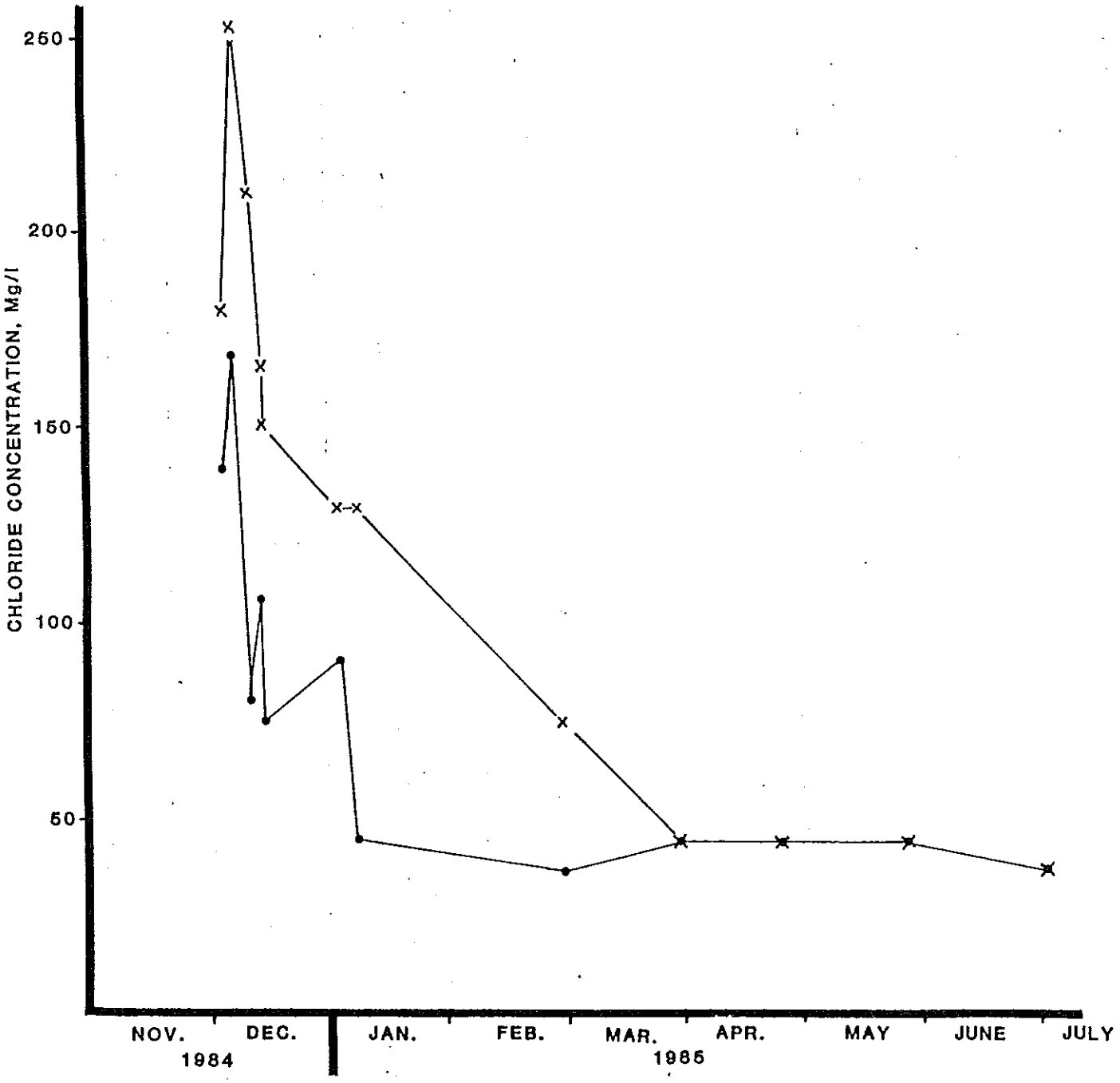
The chloride concentration during the 1984 season continued to increase for six weeks after the water levels started to recover from the maximum depth to water. This indicates that the rate at which the saline water is pushed away from the wells is initially insufficient to counteract the draw toward the producing wells.

The recurrence of high salinity at the end of the dry season in 1985 when water levels were below sea level is confirmation that sea water intrusion can be the only reasonable cause of the increased salinity in 1984 and, 1980 and 1981 as well. The increasing salinity from 1980 to 1984 and from 1984 to 1985 is indicative that ground water extractions, if increased further at the existing wells, would result in the production of unacceptable quality water for domestic purposes during at least a part of the year, unless it were adequately demineralized by costly treatment processes.

GROUND WATER PRODUCTION

Ground water from Pico Creek basin is produced from four wells: District Wells Nos. 1 and 2, the Hearst horse ranch well and the Hearst cattle ranch well. These wells are located on Figure 4. No production information was available from the Hearst wells. Production at the District wells has been recorded since 1978. Some annual production estimates for the time from 1959 to 1969 are available. Prior to 1959 and between 1969 and 1978, no information on ground water production for the District was found.

The District's Well No. 1, constructed in 1952, is equipped to yield about 340 gallons per minute from perforations placed between a depth of 15 feet and a depth of 47 feet. The District's Well No. 2, constructed in 1967, is also equipped to yield 340 gallons per minute from perforations between depths of 50 and 60 feet. These wells are operated



X Well No. 1

• Well No. 2

✖ Both Well Nos. 1 & 2

RECENT CHLORIDE TREND
SAN SIMEON ACRES CSD
FIGURE 13

TIMOTHY S. CLEATH
CEG 1102

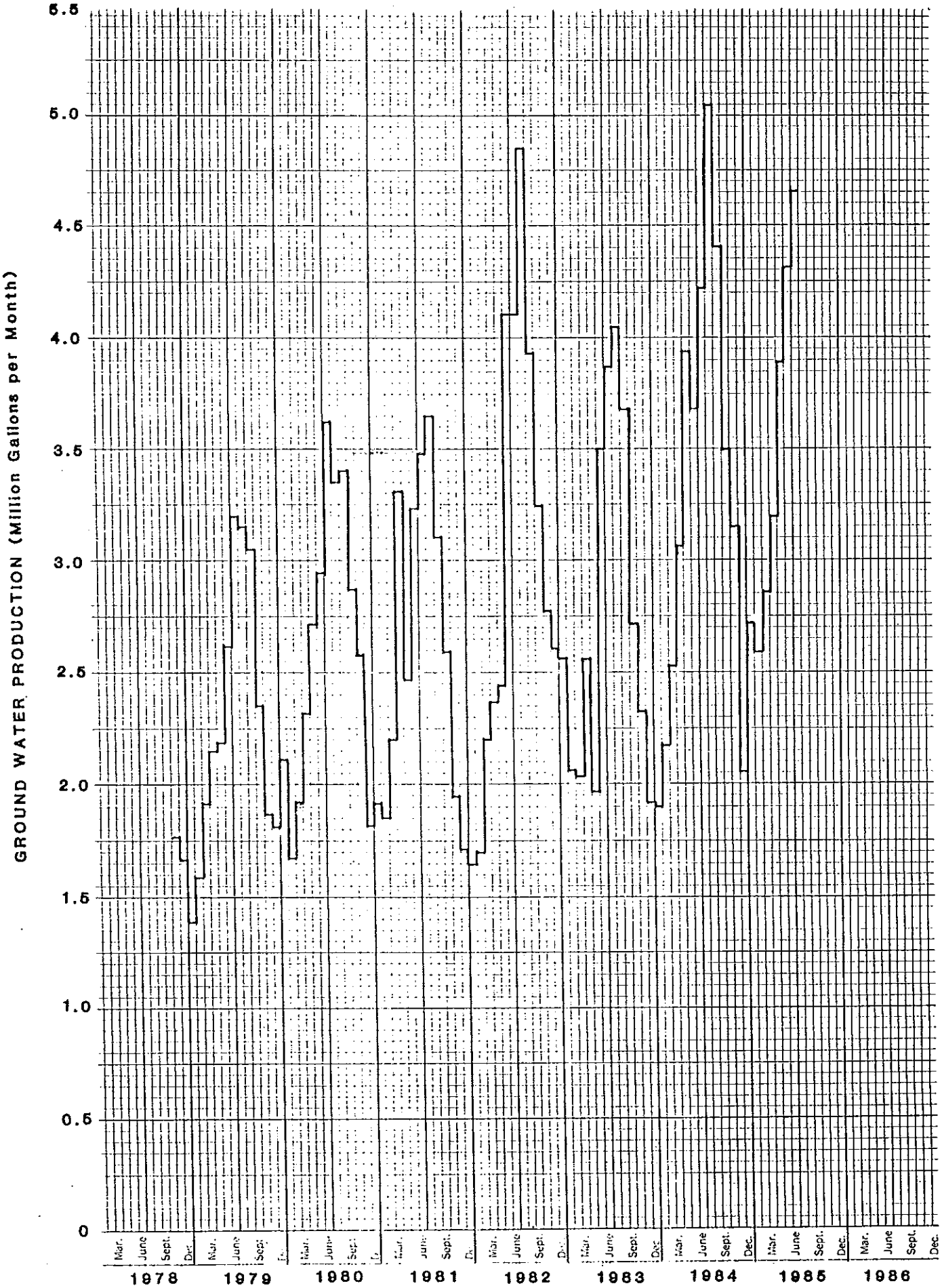
in tandem, one well pumps one day and the other well pumps the following day. The combined average continuous production rate is about 80 gallons per minute.

Fluctuations in the production per month over a years time are as much as 300 percent from the lowest to the highest demand months. The monthly production ranges from about 2 million gallons to more than 5 million gallons (Figure 14). Current average monthly production during periods of no creek flow (typically from June to November) appears to be about 4 million gallons.

Annual water production by the District has increased about 85 percent since 1978 (Figure 15). Ground water production for last year was 132 acre-feet. The Hearst wells supply water to two family residences and horse and cattle watering troughs. A small pasture is also irrigated. The amount of water required for these uses is probably about 10 gallons per minute of sustained flow.

PART I SUMMARY

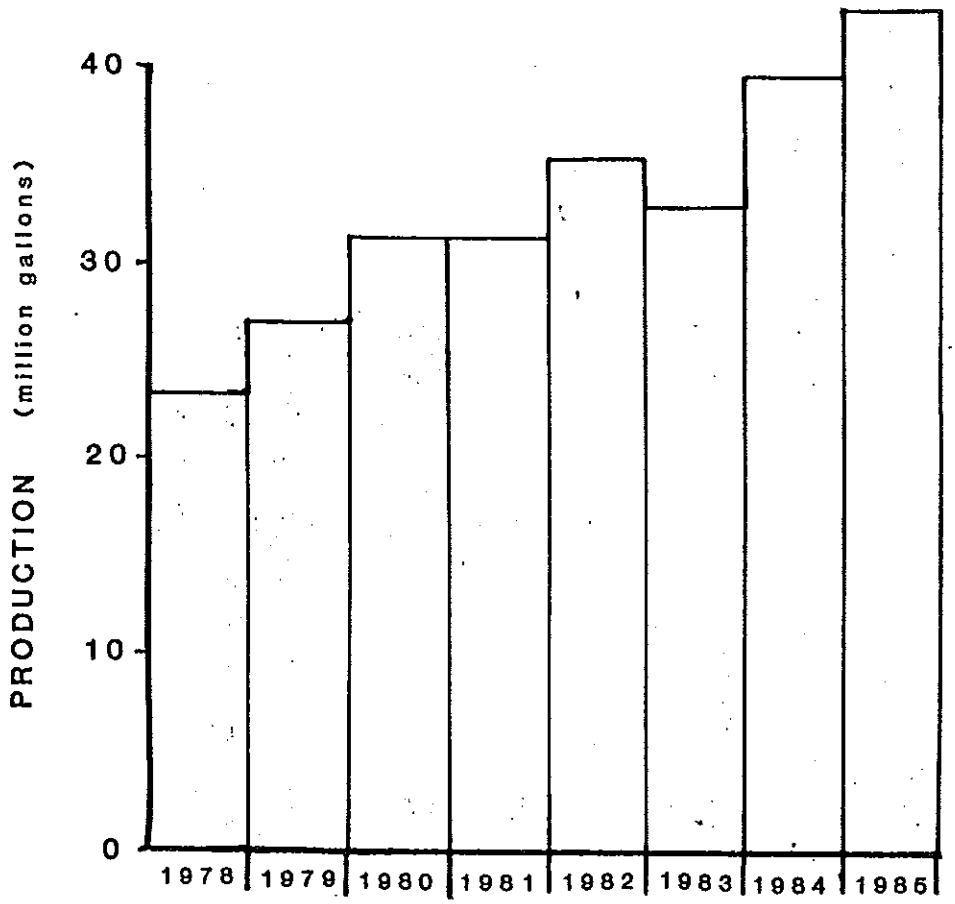
The findings reached in the previous sections point to the conclusion that sea water intrusion has occurred in Pico Creek ground water basin. The available yield from the basin will vary depending upon creek flow duration, but extractions in excess of 120 acre-feet per year during an average year of precipitation could result in impairment of the water quality, particularly chloride concentration and salinity. Currently, the District's water requirement is 132 acre-feet per year and the Hearst ranch is estimated to use 16 acre-feet of water per year.



GROUND WATER PRODUCTION
PICO CREEK WELL FIELD
SAN SIMEON ACRES C.S.D.

TIMOTHY S. CLEATH
CEG 1102

FIGURE 14



ANNUAL GROUND WATER PRODUCTION
PICO CREEK BASIN WELLS
SAN SIMEON ACRES CSD

TIMOTHY S. CLEATH

CEG 1102

FIGURE 15

PART II

FUTURE
GROUND WATER AVAILABILITY

INTRODUCTION

Phase II of the ground water investigation approaches future ground water availability from Pico Creek basin from a technical feasibility viewpoint. Policy decisions made by the District Board of Directors would determine the need to augment existing water sources using any of the measures discussed herein. The scope of Phase II included four major tasks:

1. Project water demands
2. Construct a ground water flow model to simulate changes in water level contours under no creek flow and maximum ground water extraction conditions.
3. Locate well sites based on this modelling effort should no problem with sea water intrusion be expected to occur.
4. Should sea water intrusion be found to be a potential problem, identify measures which could be taken to mitigate the impacts.

The findings of each of these tasks are described in the following sections entitled: Water Requirement; Facilities and Basin Yield; Improving the Basin Yield: Alternatives; Other Mitigation Measures.

During the course of the Phase I investigation, it was apparent that the recurrence of 1984 water quality impairment would occur. In light of this recurrence, I recommended that the Board of Directors seriously consider some short term actions such as volunteer and/or mandatory water conservation and obtaining permission from the Hearst Corporation to locate a well further up the valley for standby in case water quality impairment occurs in the District's existing wells. Although these actions have not been taken, I still recommend both actions be taken in the near future. These options are further discussed in Part II of this report.

WATER REQUIREMENTS

Projections of future water demands are necessary to determine the capacity which needs to be obtained from available water sources. Historic water use (described in Part I), the demands imposed by various uses, the resident and transient populations, and land use zoning were studied to determine the quantity of water which would be required for buildout conditions. About 60 percent of the residential zoned property and about 65 percent of the commercial zoned property have been developed.

LAND USE / WATER DUTY

San Simeon Acres has three land use categories: recreation, commercial retail, and residential multiple family. The recreation area is largely undeveloped. It is assumed that any improvement to the recreation area would not require a significant quantity of water. The commercial retail zone is currently estimated to include 10 hotels (625 rooms), 10 stores, 7 restaurants (3,000 to 4,800 patrons per day), and a gas station (200 vehicles per day). It covers an area of about 37 acres of which 13 acres have not been improved. The residential multiple family zone allows a maximum density of 26 units per acre. This zone includes a mobile home park, apartments, condominiums, and single family residences. The residential multiple family zone covers an area of about 30 acres of which about 11 acres have not been improved. For the purposes of this study, it is assumed that 75 percent of the residences are occupied and the population per unit would be 2.3.

Water uses required for each of the land uses were estimated based upon county, state, and federal guidelines. These are summarized in the following table.

TABLE 1

WATER USE

Residential, per capita	140 gpd
Hotel, per room	60 gpd
Restaurant, per patron	10 gpd
Service Station, per vehicle	10 gpd
Store, per bathroom	400 gpd
Swimming pool, per swimmer	10 gpd

Using these figures and a population of 250 permanent residents, the current demand may be broken down as follows:

Residential	39 acre-feet/year
Hotels	36 acre-feet/year
Restaurants	45 acre-feet/year
Service Station	2 acre-feet/year
Swimming pools	4 acre-feet/year
Stores	4 acre-feet/year

These values are general estimates and individual customers vary widely in consumption depending upon their methods of landscape irrigation and extent of water intensive facilities.

ADDITIONAL POTENTIAL DEMAND

The additional potential water demand which would occur at buildout depends upon the extent to which development occurs in the future. The past development densities probably are not indicative of future development because of the desirability of the area and the limited available space. These conditions tend to indicate that the existing undeveloped land would have higher intensity water consumption per acre than the existing developed area in the residential zone. Total buildout to maximum density of available commercial zoned land is not likely, due to site constraints, so an estimate should not be solely based upon planning densities and undeveloped areas.

The commercial area which could be developed includes about 10 acres of the 13 undeveloped acres. Using the present typical water use per acre for the commercial area, 3.8 acre-feet per acre, additional demand would be about 38 acre-feet.

Residential zoned areas which could be developed cover an area of about 11 acres. County Planning estimates a potential 217 units with an average population of 2.16 people/unit and water use of 140 gallons per day per capita. This would increase water demand by 73 acre-feet per year. The low occupancy rate of homes (about 75 percent) lowers the demand to about 55 acre-feet per year. Total additional water demand which could be expected would be about 100 acre-feet per year. In light of the development which has occurred over the last several years, it is possible that the buildout condition and additional water demand could be reached by the year 2010 under policies of the past year. The recent Board of Directors building moratorium action would, of course, defer further development until the action is rescinded.

PRODUCTION FACILITIES AND BASIN YIELD

As described in Part I, the District operates two wells in Pico Creek valley which have a combined capacity to produce in excess of the District's buildout water requirement. The ground water basin would not be able to yield to these wells the estimated additional 100 acre-feet of requirement for buildout conditions without degrading the ground water produced.

The movement of ground water in the basin follows an annual cycle of filling and emptying. Following the beginning of the rainy season, the creek receives runoff from the watershed area, most of which flows to the ocean. When the creek flows, it rapidly recharges the ground water stored above sea level. One day's creek flow at 30 cfs, if diverted to recharge the basin, would replenish the entire basin above sea level. The remainder of the wet season, the high fresh ground water levels force the

sea water within the basin to move towards the coast. This is a much slower process which does not necessarily force the sea water back to the prior year's position. After the creek stops flowing, ground water levels decline as water is pumped out of the basin. As the ground water levels approach sea level, the sea water in the alluvium moves inland to replace extracted ground water in the basin, preventing the water level from falling significantly below sea level. Following this, the cycle repeats itself.

Over the past several years, the fresh water/sea water interface has migrated inland at an increased rate resulting from increased ground water production. This is reflected in the increasing chloride levels of ground water produced by the District during the wet season. No data on the Hearst well water was available to identify any water quality trend. Computer simulations of ground water flow suggest that there is no water quality impact on Hearst wells resulting from the District's recent extractions. Chloride analyses performed on a regular basis would be the best means of confirming this conclusion.

The proposal to locate and produce from another well further inland would not significantly increase the basin yield. The fresh water/sea water interface has apparently continued to migrate inland over the past several years despite the high precipitation/runoff seasons in 1982 and 1983 (115% and 190% of the average precipitation). Pumping additional water anywhere in the basin would result in additional inland migration of the interface.

A well, located perhaps 1000 feet upstream of the existing District wells, could provide additional water during a time when means of augmenting or reducing the existing water supply could be implemented to meet the existing, as well as the potential future, water requirements. Improvements which could be considered by the District to increase the ground water basin yield are discussed in the following section.

ALTERNATIVES FOR INCREASING BASIN YIELD

The fresh ground water yield from Pico Creek basin in 1985 was about 50 acre-feet during the part of the year when there was no creek flow. During this period, about 70 acre-feet was produced. It is necessary, therefore, to increase the basin yield or reduce fresh ground water consumption. Measures which could be taken to increase the basin yield include three major alternatives: ground water recharge in the upstream portion of the basin, a hydraulic sea water intrusion barrier downstream of the wells, and a subsurface dam downstream of the wells. One other alternative, the removal of vegetation, would reduce basin water loss due to consumption by vegetation, but it is not likely to be acceptable on environmental grounds.

WATER SOURCES FOR GROUND WATER RECHARGE

One primary consideration in the ground water recharge and hydraulic barrier alternatives is the source of water to be used. Only two potential sources are available: (1) captured and stored runoff, and (2) reclaimed wastewater. A third source, desalinated sea water, would be a costly source ($3000 per acre-foot according to State estimates) and is rejected without further discussion.

Captured and stored runoff requires the construction of a dam across a Pico Creek tributary which could retain an adequate quantity of water to replenish the basin for the duration of the dry season. The total storage requirement would include: 30 acre-feet to meet current requirements; 70 acre-feet to supply summer demands for potential future development; and additional storage to compensate for evaporation and leakage of 100 acre-feet. The reservoir(s), then, should have a minimum of 200 acre-feet of storage.

One or two reservoirs would best be located on tributaries to the North Fork or South Fork of Pico Creek where water diverted from Pico Creek could be stored without impeding flow and fish spawning activities. The actual locations of these reservoirs remains open pending more intensive studies. The storage capacity of these reservoirs would govern the location and design of the dams. In order to preclude the more rigorous and costly procedures mandated for dams subject to the approval of the State Division of Safety of Dams, the height of the dam should be less than 25 feet from the toe of the dam to the maximum water surface.

Factors brought into play when this diverted runoff is used include site availability, permission for access and egress, regulatory requirements concerning dam construction, protection of steelhead spawning creeks, and downstream inundation. Treatment of this water would not be necessary prior to its use to recharge the ground water basin. Construction for this alternative might include two reservoirs, both using 25 foot high earthen dams, and a 14,000 foot transmission pipeline. The capital cost would be $539,500; $40,000 per dam and $20 per foot of pipeline.

Reclaimed wastewater could be used as a source if it undergoes the treatment required by regulatory agencies for disposal by deep percolation. In light of this, the existing quantity and quality of the District's wastewater treatment plant effluent has been reviewed and is described in the following paragraphs.

The wastewater treatment plant, located on about 7/10ths of an acre of property with access from the end of Balboa Avenue, is currently rated at 150,000 gal/day under a waste discharge permit issued by the Regional Water Quality Control Board on February 24, 1984. The District has just recently completed expansion of the plant to allow for its rated capacity of 0.15 MGD. In 1985, the plant processed approximately 36

million gallons of effluent, including about 4 million gallons of effluent tributary from the Hearst Castle visitor receiving station (Figure 16). Therefore, in terms of effluent produced as a percentage of the water production, approximately 74.6% of all water produced winds up in the District's treatment plant. The treated effluent is disposed of via an ocean outfall.

The treatment level provided at the District's wastewater treatment facilities, as described in the Plant Superintendent's annual report submitted to the RWQCB for the calendar year 1985, will meet the definition of secondary level of treatment. However, the existing District plant, does not include means of meeting the bacterial requirements of 2.2 MPN/100 mg/ml coliform (median) for enhanced usage. It is apparent from the report (wherein the average monthly effluent coliform count was approximately 7.0) that the District could meet the 23 MPN/ 100 ml level (Figure 17). Meeting the bacterial requirements for higher degree of treatment would require coagulation and filtration.

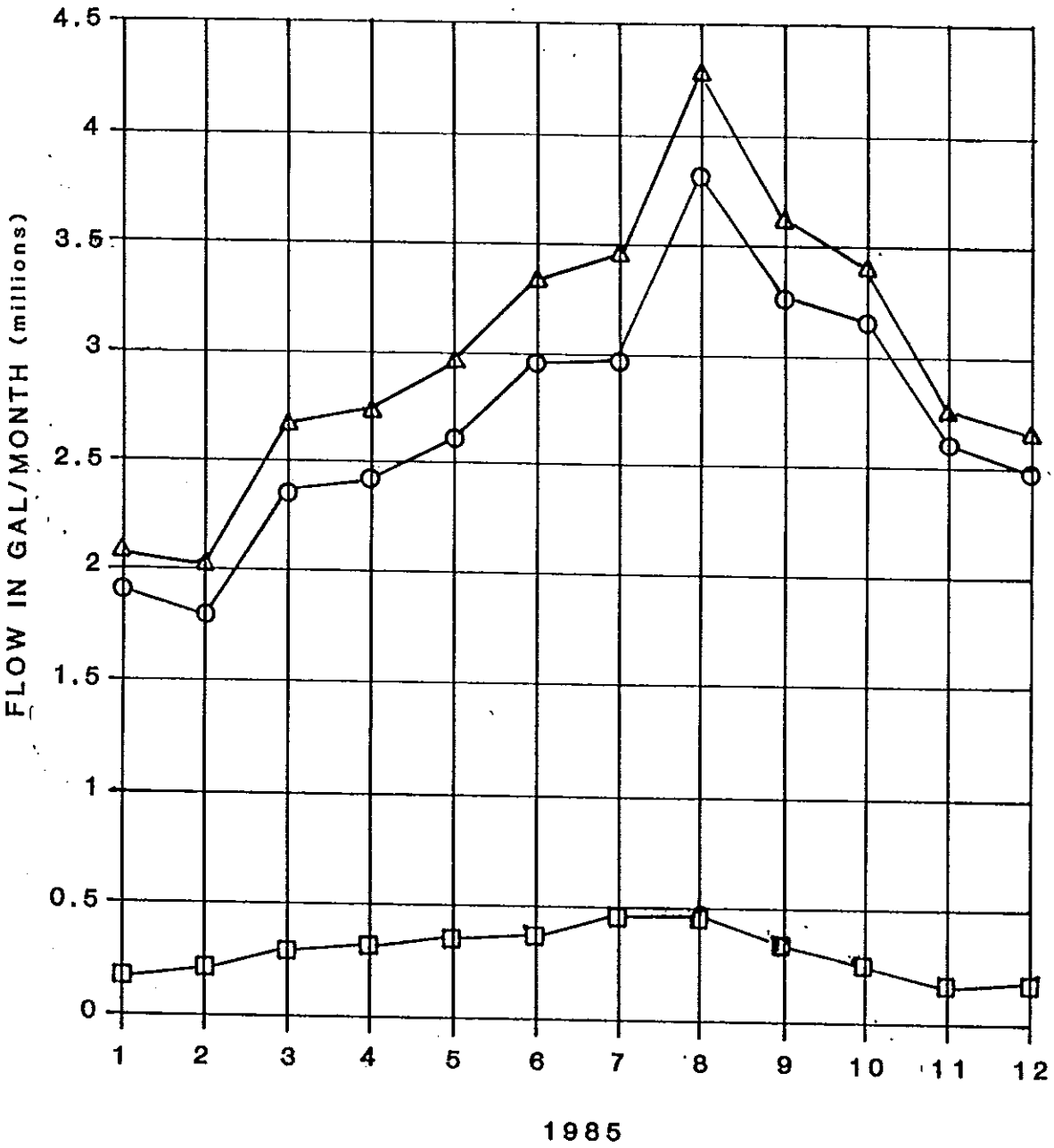
The mineral constituents of the plant effluent appear to be at much higher concentrations than the delivered ground water, but within the state drinking water maximum contaminant levels (with the possible exception of nitrates). Complete mineral analyses of the effluent are not available for the past several years. Some of the mineral constituent concentrations are summarized in Table 2.

TABLE 2

SUMMARY OF INORGANIC CONSTITUENTS
WASTEWATER EFFLUENT

Constituent	Units	Concentration
Specific Electrical Conductance	μmhos	1436[1]
Total Dissolved Solids	mg/l	784[1]
Chloride	mg/l	242[1]
Boron	mg/l	0.32[1]
Ammonia Nitrogen	mg/l	1[2]
Arsenic	mg/l	<0.01[2]
Cadmium	mg/l	<0.001[2]
Copper	mg/l	0.03[2]
Fluoride	mg/l	0.4[2]
Lead	mg/l	<0.006[2]
Nickel	mg/l	<0.02[2]
Zinc	mg/l	0.11[2]
Chromium	mg/l	<0.005[2]
Mercury	mg/l	0.0002[2]
Silver	mg/l	<0.01[2]

[1] Sample Date: 3/19/69
[2] Sample Date: 7/85



□ HEARST CASTLE FLOW

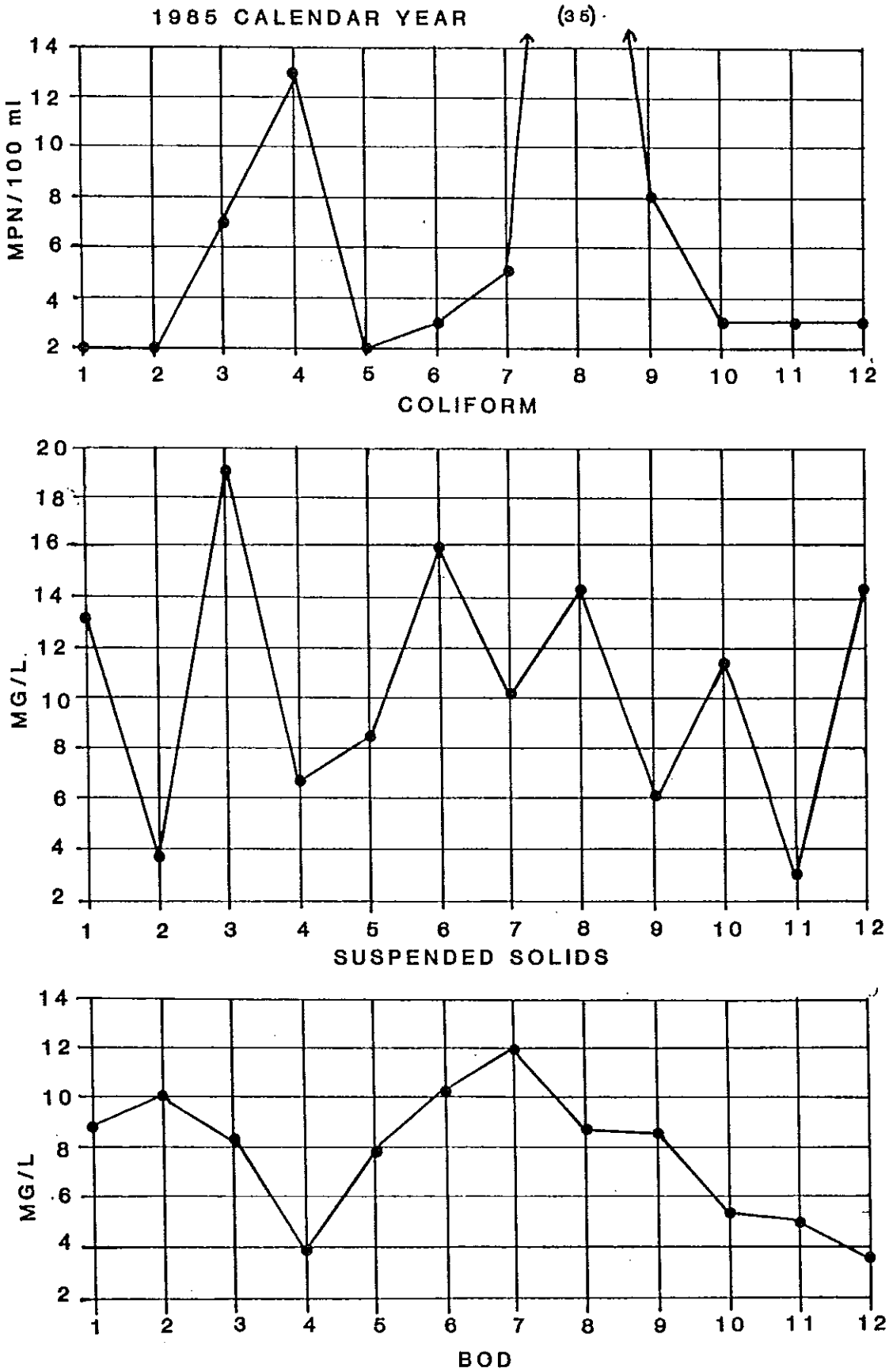
△ TOTAL FLOW

○ SSACSD FLOW

WASTEWATER FLOW
SSACSD PLANT
SAN SIMEON ACRES CSD

JOHN L. WALLACE & ASSOCIATES

FIGURE 16



JOHN L. WALLACE & ASSOCIATES

WASTEWATER EFFLUENT QUALITY
SAN SIMEON ACRES CSD

FIGURE 17

A more recent and complete general mineral analysis would be a necessary precursor to any use of the reclaimed effluent for ground water recharge.

The degree of treatment required to enable the use of reclaimed effluent for discharge to the ground water basin would be determined by the State Department of Health Services. The treatment required is in part dependent on whether or not the percolated reclaimed effluent recharges the District's wells. The recent drawing of the sea water inland under lesser gradients indicates that the ground water gradient would be from the percolation basin to the wells during some time of the year. This could result in some reclaimed water recharging the District's wells for a part of the year. The distance between the percolation basin and the wells, if greater than a few hundred feet, would allow the filtration and removal of microorganisms prior to inflow into the wells. Should the distance between the percolation basin and the wells be deemed adequate, no additional treatment would be required. If the distance is not adequate, further treatment could be required, possibly including coagulation and filtration.

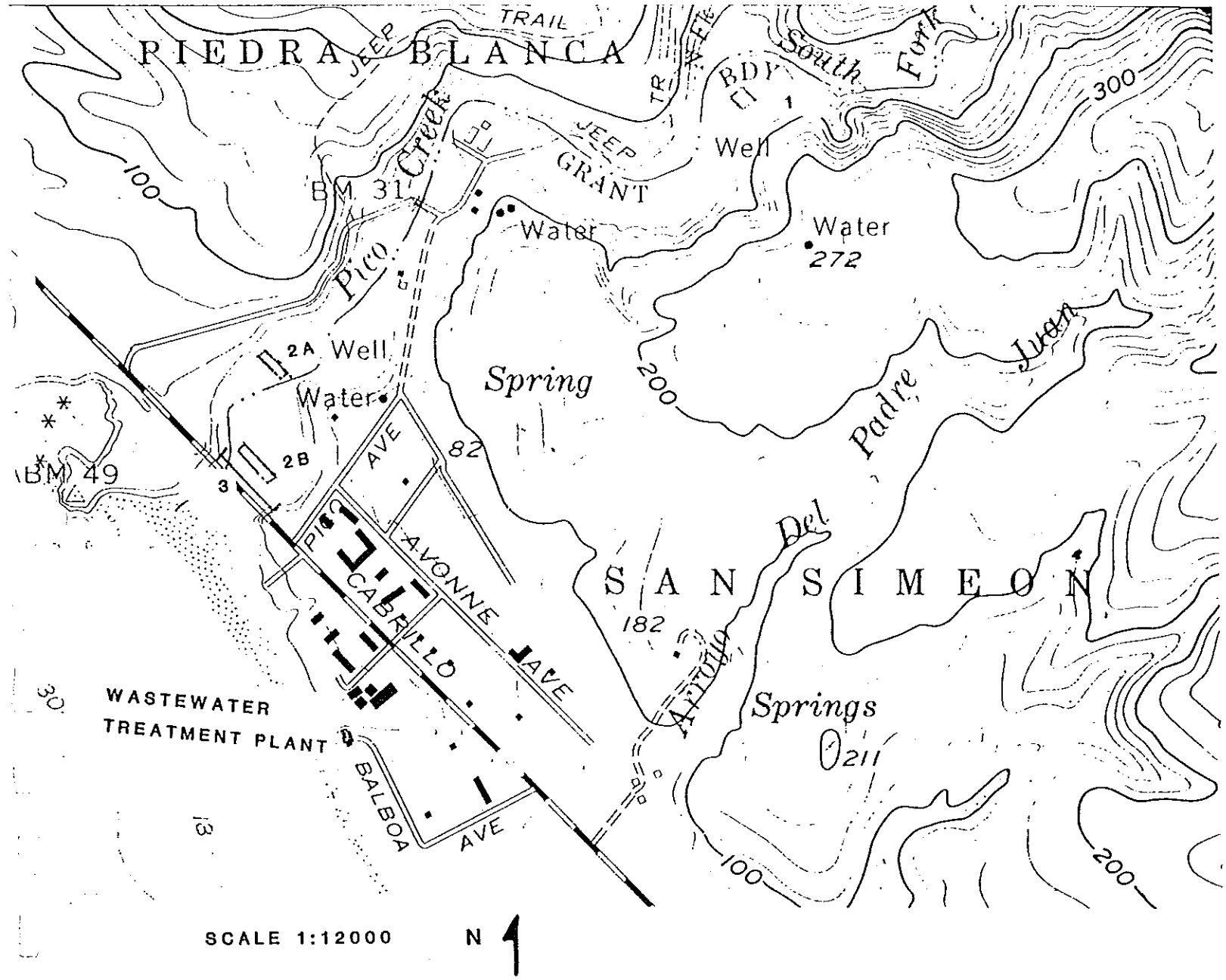
Comparison of the costs of each alternative would be directly impacted by the treatment requirements. Capital costs for coagulation and filtration and pump station facilities are estimated to be $165,000 with annual operating costs of $38,000.

LOCATIONS OF POTENTIAL GROUND WATER RECHARGE FACILITIES

Two areas where potential recharge facilities could be located are (1) in the pasture area upstream of the Hearst horse stables and (2) in the vicinity of the ponds upstream of Highway 101 (Figure 18). Both locations are within the Hearst property and would require some arrangement with the Hearst Corporation.

The area required for a recharge basin would depend upon the percolation rate of near surface sediments. If the fine-grained soils are removed, the percolation rate of the underlying gravels would be very rapid (more than 20 inches per hour) according to the Soil Survey of San Luis Obispo County. At a rate of 20 inches per hour, a surface area of 1000 square feet would percolate more than 200 gallons per minute. The pond area near Highway 101 or an elongated basin whose axis is perpendicular to the basin could be used to percolate this water. This basin should not require much more than one acre.

The upstream location of the percolation basin would be used in conjunction with stored runoff for several reasons: (1) the transmission line from a reservoir upstream would be shorter than from the wastewater treatment plant, (2) a gravity flow system could be installed precluding electrical costs, (3) the water quality of the source water would be equal or better than the ground water, (4) the transmitted water could be used beneficially by the ranch when recharge operations are not



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EXPLANATION

1 RECHARGE SITE ALTERNATIVE 1

PERCOLATION POND SITE

HYDRAULIC SEA WATER INTRUSION BARRIER

SUBSURFACE BARRIER SITE

POTENTIAL SITES

ALTERNATIVES
TO INCREASE BASIN YIELD
SAN SIMEON ACRES CSD

FIGURE 18

required in the wet season, and (5) aesthetics of a fresh water basin may be more acceptable to the Hearst Corporation than reclaimed effluent. The cost of the recharge facilities is estimated to be $15,000 with a maintenance cost of $2000 per year.

The recharge basin location downstream of the District's wells would favor the use of reclaimed effluent over stored runoff in several respects: (1) a shorter transmission line and minimal lift would be required, (2) the quality of ground water in the area is typically poorer than the quality of the effluent. Other favorable aspects of locating the percolation basins in this area are: (1) the area is undeveloped and generally inaccessible to the public, but readily accessible to the District, (2) the percolation basin could be located in an area obscured to view, (3) the recharged water would have a quicker beneficial impact on the quality of ground water near the coast which is being drawn toward the District's wells during the dry season. Percolation of water in this basin would create an artificially high water level which, during periods of low ground water levels upstream, would function to prevent sea water intrusion while the percolated water also recharges the ground water basin. The cost of constructing and operating the basin would be similar to the cost for the basins at the upstream location.

SUBSURFACE DAM

In contrast to the two alternatives already described, a third alternative would not require a new source of water, would not take up additonal ground surface area, and would not require maintenance. This third alternative would be the construction of a subsurface dam across Pico valley at a location near the coast (Figure 18). The dam would serve to prevent inflow of sea water into the ground water basin and thereby make available fresh ground water in storage below sea level without any quality degradation. The ground water in storage in the basin could be depleted during the dry season and rapidly replenished by winter creek flow much as the portion of the basin above sea level now operates.

At this time, much of the ground water stored in this portion of the ground water basin has already been degraded. This water may need to be pumped out and fresh water replenished before the ground water in storage below sea level would be of acceptable quality for use.

The total amount of ground water in storage when the basin is full is estimated to be 214 acre-feet. Perhaps 80% of the ground water in storage is assumed to be available resulting in a dry season yield of about 170 acre-feet. This amount should be adequate to supply the existing Hearst Ranch requirements and the District's ultimate water requirements when augmented with subsurface inflow and stream recharge during the wet season.

Probably two more wells located upstream of the dam would be required to adequately produce the ground water in storage. The Hearst Ranch wells may not be operable during the period when water levels are exceptionally low. This would necessitate that the Hearst Ranch requirements be supplied from the District's wells or new wells of their own.

The subsurface dam could be constructed by trench and slurry or drill and injection methods. For a dam 400 feet wide and an average of 40 feet deep and 2 feet thick, constructed using the drill and injection method, the cost would include the drilling cost of 200 holes averaging 40 feet deep and the materials and injection cost for 90,000 gallons. The cost is estimated to be $300,000.

OTHER MITIGATING MEASURES

The District has other choices available as means to balance the available water supply and demand.

One choice is to institute a program of water conservation to reduce the overall water demand to a point where the available water supply is sufficient and to prevent further development. This would have a minimal cost. Water conservation measures were described earlier to the Board of Directors in a letter included in this report's appendix.

Another choice is to use the reclaimed effluent as a source to meet impoundment or irrigation demands. Existing landscape uses would, however, require that the effluent undergo filtration and coagulation and that a parallel non-potable line be installed with a pumping station. This choice would involve a capital outlay of $360,000 and an annual operating cost of $24,000 to produce, at present, about 33 acre-feet per year and 58 acre-feet per year at buildout.

A third choice would be to desalinate sea water. The State Department of Water Resources estimated the cost at $3000 per acre-foot in 1985. The treatment plant could be designed for whatever the quantity desired would be.

The fourth choice would be to explore the surrounding area for a well site by drilling several holes in search of a fractured bedrock aquifer. The potential yield of such a well would be impossible to predict at this time due to the absence of any bedrock well in the area capable of producing more than a few gallons per minute. This option has no assurance of success and as such can not be costed or otherwise addressed. Should the District be interested in pursuing this course of action, I could suggest some areas which could be explored during further studies.

One final choice would be to work with Cambria in their efforts to obtain additional water and participate in the fruits of this effort. Their efforts will not be completed for some time to come, however.

FUNDING

Three state and federal funding programs could provide financial assistance to the District, should the District select particular alternatives related to water reclamation and ground water recharge.

The Water Reclamation Loan Program implemented by the State Water Resources Control Board provides low interest loans under the Clean Water Bond Law of 1984. This program could provide loan funding at half the rate paid by the State on general obligations bonds for the wastewater treatment and recharge option.

Two other programs could offer assistance for the ground water recharge options. One program enacted by the state legislature as AB 1156 is the Ground Water Recharge Facilities Financing Act, for which a bond is being placed on the June 1986 ballot. This will be administered by the Department of Water Resources and would provide a similar loan to the Water Reclamation Loan Program. The third financing option would be to qualify for 80 percent grant funding from the U.S. Bureau of Reclamation as a "Ground Water Recharge Demonstration Project." This project funding information, already in the hands of the District, would require an immediate response (due April 1, 1986) to the State Department of Water Resources to gain consideration. The competition to obtain this funding may be considerable in light of the limited number of projects to be funded. From the descriptions of the initial two funding programs, it appears that any of the three options could qualify for one of the programs should the third source of funding not be available. Therefore, in the following comparison of costs for each of the three alternatives, a loan interest rate would be based on the first two funding sources.

COMPARISON OF ALTERNATIVES

The three alternatives which could increase the Pico Creek ground water basin yield are compared on the basis of cost (Table 3) and non-cost considerations (Table 4).

The cost comparison shown in Table 3 presents the capital cost, annual operating cost, and the influence of various funding sources. The subsurface barrier alternative is the lowest cost alternative, primarily due to the absence of annual operating costs. The lower pumping water level would result in a minor additional cost. The subsurface dam could be expected to last considerably longer than the twenty year amortization period, thereby reducing the annual cost of its replacement. Recharge of stored runoff was the next lowest cost alternative when the State financing is obtained, primarily due to lower operating costs than the treatment and percolation of reclaimed effluent. With private financing, the reclaimed effluent percolation is lower in cost than the runoff recharge concept.

Cost is not the only consideration when it comes to the project alternatives. Several non-cost considerations were identified and each alternative was ranked A, B, or C to indicate the most favorable alternative to the least favorable alternative. The weight of each consideration in evaluating the alternative must be determined by the District. Some of the considerations are similar to those concerns addressed by environmental impact studies.

The considerations identifying the Hearst Corporation are not based on any commitments or comments made by the Hearst Corporation. Rather, the rankings reflect what the author feels are in the interests of the Hearst Corporation. Certainly, the more land required, the greater is the reliance that the District must have on the Hearst Corporation. Benefit is based on the additional water which could be available to the Hearst Corporation as a result of each alternative.

The flexibility aspect of the stored runoff recharge reflects the possibility of constructing one reservoir now and one later and the capability to accept or restrain flow for recharge. The impact on the lagoon by the subsurface barrier would be such that a portion of the lagoon would be dry during a part of the year which otherwise would be wet. The impact on the stream, although ranked, probably would not be significant for any of the three alternatives unless a dam site chosen for the runoff recharge alternative would impact steelhead spawning.

Water quality is an important consideration and is distinctly different for each alternative. The runoff recharge would have the lowest mineral content. The subsurface dam would require the removal of any brackish water upstream and this could take some time to accomplish. The reclaimed effluent would most likely have the most mineral content, although blending with the fresh ground water would result in somewhat less minerals by the time the water reaches the wells.

PART II SUMMARY

The ground water basin yield can be increased through the implementation of one of three alternatives. These alternatives are: (1) ground water recharge of captured and stored Pico Creek flow; (2) percolation of reclaimed effluent from the District's wastewater treatment plant to prevent sea water intrusion at the mouth of the valley; and (3) construction of subsurface dam at the mouth of the valley to prevent sea water intrusion and increase the amount of useable ground water in storage.

Alternative three is the least expensive, but would require additional borings to define the downstream depth to bedrock. It would require the installation of additional wells and could dry up a portion of the lagoon and ponds.

Alternative 1 would be the second least expensive alternative due to the absence of significant operational costs and would provide the best quality water. This alternative would be the most subject to the Hearst Corporation cooperation. Furthermore, dam sites would need to be selected before the engineer's estimate of construction cost could be made.

Alternative 2 has the lowest capital cost, but operational costs result in the highest cost per acre-foot. At higher interest rates; this alternative is less costly than the runoff recharge. The main consideration, both economic and non-economic, could be the acceptability of the water quality. The regulatory agencies would determine if further treatment above the existing level of treatment is necessary. The additional treatment results in 80 percent of the cost. The public perception of using ground water recharged by reclaimed effluent would be the non-economic aspect of the water quality consideration.

Finally, funding has a key role in the District's direct cost for these alternatives. If the District could participate in the U.S. Bureau of Reclamation Ground Water Recharge Demonstration Project program, the least amount of local cost would be incurred. If not, funding from one of the other State programs for low cost loans should be sought.

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APPENDIX

Reconstitution of Historic Period

Rainfall records over the last hundred years at Cal Poly San Luis Obispo along with available records at Point Piedras were used to expand the fabricated records for Pico Creek. The stream flow records for Arroyo De La Cruz were also included in the analysis. These reconstituted flows were generated through the use of the U.S. Army Corps of Engineers program HEC-4. The output computer file is attached for your reference.

The HEC-4 program employs a statistical methodology for generating flow information. This method looks at means, standard deviations, correlations with previous months and cross correlations with other stations. It does not try to simulate physical processes and it does not make any flow predictions. It is simply an aid to evaluate the statisical properties of flow and the generation of statistically similar flows.

Flow - Duration - Frequency

The data generated in the previous step was reviewed each water year for the lowest monthly, bi-monthly, tri-monthly, quarter-annual, semi-annual and annual average flows. For a given average flow the number of years with less than or equal values were counted. For the durations less than semi-annual the results were such that flow-frequency data can be descibed by the percent chance that a zero flow condition will occur for a given year.

Duration	Percent
1 month	100%
2 months	96%
3 months	93%
4 months	78%
6 months	26%

For the semi-annual and annual cases the following table presents the flow-duration-frequency results. A curve was not presented due to the limited number of non-trivial points.

Frequency	6 Month Duration Flow (cfs)	1 Year Duration Flow (cfs)
50-year	0	0.802
10-year	0.007	3.274
5-year	0.029	5.999
2-year	0.210	13.358

For each of these durations a linear regression in log-space was done with the records of counted occurances in the HEC-4 generated data, to estimate average flows for distinct return periods.

PICO CREEK HYDROLOGIC STUDY

The following breifly outlines the method used in reconstructing the last 100 years of monthly stream flows for Pico Creek and the subsequent flow duration analysis.

Basic Data

Stream flow and rainfall records along with mapping of soil types, mean annual precipitation, and watershed topographic maps were were collected and reviewed for the coastal region near Pico Creek. Watersheds considered included Santa Rosa Creek, San Simeon Creek and Arroyo Del La Cruz.

Relationship to Adjacent Watersheds

Adjacent gaged watersheds were investigated for relationships with Pico Creek. Two watersheds were selected as being the most similar to Pico Creek. The Santa Rosa Creek near Cambria and the San Simeon Creek gages were used to estimate Pico Creek monthly stream flows based on the simple proportioned relationships of the watershed area and area averaged mean annual precipitation. Soil types between the basins after review were assumed to have negligible differences in runoff characteristics. Using the period of overlap on the two gaged stations the relations between both gages were averaged.

$$Q(p1) = A(p)/A(sr) \times P(p)/P(sr) \times Q(sr) = 1.013 \times Q(sr)$$

$$Q(p2) = A(p)/A(ss) \times P(p)/P(ss) \times Q(ss) = \cancel{1.013}\ 0.595 \times Q(ss)$$

$$Q(p) = [Q(p1)+Q(p2)] / 2$$

Where:
- p = Pico Creek
- sr = Santa Rosa Creek
- ss = San Simeon Creek
- Q = Flow in cfs
- P = Area Averaged Mean Annual Precipitation in Inches
- A = Watershed Area in Acres

Stream	Area (acres)	Mean Annual Precip. (inches)
Pico Creek	13.5	38.14
Santa Rosa Creek near Cambria	12.5	40.67
San Simeon Creek	22.9	41.24

LITHOLOGIC LOG

SITE 1: PICO CREEK VALLEY

300' towards coast from existing District wells #1 & 2

130' from south side of valley

Edge of horse pasture

DEPTH (FEET)	DESCRIPTION	
0-3	Brown	loam
3-12	Gray	cobbles, loose, rounded, 6-inch diameter, subspherical, hard, metamorphic clasts
12-18	Dark brown	medium to coarse sand, loose
18-20	Brown gray	gravel and sand, loose, rounded, subspherical, < 1 cm., serpentine, chalcedony, metamorphic clasts
20-22		sand
22-23	Brown	fine to coarse sand and gravel, loose, rounded, subflat to subspherical, 3 cm., serpentine, sandstone, hornfels, and quartz clasts
32-37	Brown gray	clay with very fine sand, cohesive
37-45	Gray brown	fine to coarse sand, loose
45-56	Dark gray-brown gray	gravel and coarse sand, loose, coarser gravel (3 cm.) at bottom, rounded, sandstone, chalcedony, diorite clasts
56-59	Gray brown	clay with gravel, cohesive, rounded, subspherical, < 3 cm., serpentine, sandstone, and hornfels clasts
59	Black	clay and shale, cohesive, brittle, decomposed Franciscan rock

LITHOLOGIC LOG

SITE 2: PICO CREEK VALLEY

350' from Site #1

350' from District Well #2

35' from creek bank

DEPTH (FEET)	DESCRIPTION	
0-5	Light brown	sandy loam soil
5-20	Brown gray	cobbles, gravel, and coarse sand, loose, rounded, subflat-subspherical, gravel 3 cm. max., cobbles at 5' & 16.5'
20-29	Dark brown-brown gray	fine to coarse sand, some gravel, loose
29-31	Gray brown	gravel and coarse sand with some silt, loose, rounded, subflat, 3 cm., quartzite, serpentine, jaspar clasts
31	Black	clay and angular chips of shale, hard

LITHOLOGIC LOG

SITE 3: PICO CREEK VALLEY

380' from Site 2

200' from south side of valley

30' from creek bank

570' from District Well #2

DEPTH (FEET)	DESCRIPTION	
0-4.5		sand with silt
4.5-15	Dark brown	fine to coarse sand and gravel, loose, rounded, subspherical, <3 cm, cobbles at 4.5', quartzite and chalcedony clasts, EC: 580μS
15-25	Brown	fine to medium sand with some silt and gravel, slightly cohesive, clasts are subrounded and subflat
25-27	Brown	coarse sand to medium gravel (½ cm), loose, subrounded, tuff,quartz and lithic clasts
27-34	Green brown	fine sand with clay, moderately cohesive
34-36	Dark brown gray	fine to medium sand, some silt, slightly cohesive
36-48	Brown gray	fine to coarse sand with gravel, loose, rounded, subflat to subspherical, <1 cm, serpentine, chalcedony, sandstone, dacite and diorite clasts, EC:520μS
48-50	Tan brown	gravel and coarse sand, some minor silt, subrounded, subflat, <2 cm, serpentine and metamorphic clasts
50-55	Brown	gravel and coarse sand, some silt, hard, rounded, subflat to subspherical, <2 cm lithic clasts
55		consolidated dry clay and gravel

LITHOLOGIC LOG

SITE 4: PICO CREEK VALLEY

110' south of bridge at stables

130' from south valley wall

Along ranch road

DEPTH (FEET)	DESCRIPTION	
0-5		soil
5-6		clay and gravel (1 cm) dry
6-14	Brown	fine to coarse sand, some gravel 10'
14-20	Brown gray	gravel and coarse sand, loose, rounded, subspherical, <2 cm, sandstone and vitrified tuff clasts
20-22	Light brown	gravel, cobbles, sand and clay, cohesive, rounded, subspherical, 3 cm, sandstone, claystone and metamorphic clasts
22-26	Gray brown	cobbles and fine sand, slightly cohesive, rounded, subflat to subspherical, 3 cm+, sandstone, serpentine and hornfels clasts
26-38	Gray brown mottled	clay and silt, cohesive
38-42	Brown gray	fine to medium sand with gravel, slightly cohesive, rounded, subspherical, <2 cm, chalcedony and sandstone clasts
42-57	Dark gray-gray brown	gravel and coarse sand, loose, rounded, subflat-subspherical, <1 cm, decomposed, metavolcanics, diorite, serpentine, sandstone, chalcedony clasts
57	Yellow-brown-maroon banded	clay with minor gravel, compact, dry, decomposed gravel

LITHOLOGIC LOG

SITE 5: PICO CREEK VALLEY

80' from north valley wall

35' from creek bank

180' from south valley wall

1500' downstream from upper ranch well

Above stables next to goat pen

DEPTH (FEET)	DESCRIPTION	
0-6	Brown	sand and silt
6-16	Brown gray	gravel with sand and silt, subrounded, subspherical, <3 cm, serpentine, quartzite, chalcedony clasts
16-26	Brown gray	medium sand and cobble gravel, some silt, rounded, subflat to subspherical, decomposed sandstone, serpentine and lithic clasts
26-31	Brown gray	cobble gravel with some sand and silt (<5 %), rounded subflat, <2 cm, quartzite, breccia clasts
31-36	Gray	medium to coarse sand
36-42	Brown gray	cobble gravel with silt (5-10 %), mod. cohesive, rounded, subflat, chalcedony, quartzite, and lithic clasts, hard, most clasts ¼ cm, some to 3 cm
42	Brown-ochre	clay and gravel, dry, subrounded, subflat, serpentine and chalcedony clasts, some brittle

LITHOLOGIC LOG

SITE 6: PICO CREEK VALLEY

500' upstream from Site #5

150' from north valley wall

250' from south valley wall

110' south of creek bank

DEPTH (FEET)	DESCRIPTION	
0-4	Brown	sand and silt
4-16	Brown	coarse sand with gravel, some silt, loose, subflat to subspherical, <2" lithic (tuff, chert) clasts
16-22	Gray brown	pebbles, gravel with coarse sand, loose, angular to rounded, subspherical, <2", serpentine, chalcedony, sandstone clasts
22-28	Brown	pebbles, gravel with fine to medium sand, some clay, subrounded to subangular, flat to spherical, quartzite-sandstone clasts bound by maroon, tan, blue banded clay

INTERPRETIVE DRILLING LOG

SITE 7: PICO CREEK VALLEY

420' upstream of Site 6

200' from mouth of draw on south valley wall

60' south of creek bed

DEPTH (FEET)	DESCRIPTION	
2-7		gravel and cobbles
7-15		sand and gravel
15-16		sand
16-34	Gray brown	gravel, pebbles with coarse sand, some silt, rounded, subspherical, <1.5 cm lithic clasts
34-36		coarse sand, gravel and clay
36	Gray brown	gravel, pebbles with some clay, consolidated, angular, subspherical jasper and sandstone, gray clay rock flour, hard drilling

LITHOLOGIC LOG

SITE 8: PICO CREEK VALLEY

50' from Well #1 toward side of valley

DEPTH (FEET)	DESCRIPTION	
0-15	Brown	clay and silt, cohesive
15-18	Gray	gravel and coarse sand, loose, subflat, rounded lithic clasts (some brittle)
18-27	Gray brown	medium sand with gravel, silt matrix, rounded and subspherical (18'-24'), angular, subflat (24'-26'), hornfels, sandstone, chalcedony, clasts to 2 cm
27	White green	dry silt with coarse sand, angular, subspherical, chalcedony fragments, some banding

Timothy S. Cleath
Engineering Geologist
Ground Water
(805) 543-1413
1390 Oceanaire Drive
San Luis Obispo
California 93401

October 23, 1985

Mr. Lonnie Price, President
Board of Directors
San Simeon Acres Community Services District
Rt. 1 Box S-17
San Simeon, CA

SUBJECT: WATER CONSERVATION

Dear Mr. Price:

In light of the ground water studies I have been involved with for the District, I believe that sea water intrusion will contribute substantially to degradation of the quality of water produced by the District's wells during the next couple of months. The mineral constituents should continue to increase until Pico Creek again becomes a flowing stream, recharges the ground water and pushes the sea water towards the coast.

The time for mandatory conservation has arrived and should be maintained for the period of time when the water levels in the wells are below a level of two feet above sea level. The City of Morro Bay faces a similar crisis this year and has developed a program for voluntary and mandatory water conservation. The measures comprising this program are described in the attachment.

In addition to these measures, other options include: (1) a letter to consumers informing them of the water shortage, (2) increased water rates for usage above a set minimum, (3) a leak and waste detection program (door to door and within the system mains and laterals), and (4) a retrofit program to convert high flow faucets, toilets, and showerheads to low flow in hotel rooms and residential units (some adapters are available free from the State Department of Water Resources). These measures are generally short term, but may also have long term benefits.

The longer the effort for water conservation is delayed, the more severe will be the degradation of the well water quality. Sea water intrusion which appeared to occur last year resulted in an increase in chloride concentrations to near the maximum allowable level of 500 mg/l. The chloride level this year has a potential for being much greater. Total dissolved solids may also exceed the maximum contaminant level.

Should water production levels remain higher than subsurface fresh water inflow and water quality is degraded to this potential level, emergency water quality treatment would need to be considered. This would involve considerable expense and the need to obtain permits from the County and State Health Departments and the Regional Water Quality Control Board. Another option would be to place, on line, an alternative water source for short term purposes. The assistance of the County and State agencies as well as Cambria Community Services District and the Hearst Corporation could be of value to the District in dealing with this critical situation.

The potential ground water quality degradation and the water conservation measures outlined in this letter are pesented as my perceived assessment of existing conditions and optional remedial approaches. Mr. McWherter is being consulted to ascertain his recommendations regarding water conservation and temporary water supply augmentation/water quality treatment. If you would like me to discuss this further with the Board, I would be happy to meet with them.

Very truly yours,

Timothy S. Cleath
Engineering Geologist

in or out of the City limits, are hereby notified that due to the depletion of available water supply in the municipal well system, the following mandatory water conservation measures will be in effect beginning at 6:ØØ a.m. on _____ 1985, and continuing for the duration of the present low-water condition. Failure to comply with these limitations may result in a fine. REPEATED VIOLATIONS MAY RESULT IN TURNING OFF OF THE VIOLATOR'S WATER SERVICE.

1. Outdoor Irrigation:

   a. No outdoor irrigation is permitted between the hours of 1Ø:ØØ a.m. and 4:ØØ p.m.

   b. Use of automatic or sprinkler irrigation is prohibited. Hand watering shall be the only permitted method of irrigation and only during established periods.

   c. Irrigation of domestic landscaping and gardens is permitted at even-numbered street addresses only on Wednesdays and Sundays, and at odd-numbered street addresses only on Tuesdays and Saturdays.

   d. Irrigation of City parks and public school landscaping is prohibited.

2. Marinas and Waterfront Installations:

   a. Use of fresh water to wash down boats, docks, or other incidental activities is prohibited.

   b. All hose bibs shall have spring-loaded shut-offs or similar controlling devices.

3. Restaurants shall serve drinking water in response to a specific request by a customer.

4. Use of water which results in gutter runoff is prohibited.

   a. No water shall be used for cleaning of driveways, patios, parking lots, sidewalks, streets, or other such uses.

   b. Washing cars by use of a hose is prohibited. Use of a bucket is permitted, and then subject to non-wasteful applications.

   c. Hose down of buildings, washing of windows except by bucket, or similar activities is prohibited.

5. Filling or refilling of swimming pools is prohibited.

6. Use of potable water for compaction or dust control purposes in construction activities is prohibited.

RUN #1
DISTRICT WELLS Q=0.19cfs

SALT WATER-FRESH WATER FLOW ANALYSIS

****

Cleath SeaWater Intrusion Project

****

FINITE DIFFERENCE DATA

NUMBER OF -	COMLUMNS	19
-	ROWS	9
-	NON-ZERO BLOCKS	119
-	NOT USED	0
-	MAXIMUM TIME STEPS	90
-	SOURCES	3
-	CONSTANT HEADS (SALT)	6
-	CONSTANT HEADS (FRESH)	0
-	LAGGING ITERATIONS	20

TIME PARAMETERS

INITIAL TIME STEP IN SECONDS	86400.000
WEIGHTING PARAMETER	1.0
OVER-RELAXATION FACTOR	1.0

ALPHA = 1.0 WATER TABLE CONDITIONS

THE FOLLOWING ARE UNIFORM:

X-spacing
Y-spacing
initial fresh water heads
X-hydraulic conductivity
Y-hydraulic conductivity
specific storage

specific storage

MULTIPLICATION FACTORS FOR

X-spacing	1.00
Y-spacing	1.00
initial fresh water head	1.00
initial interface elevation	1.00
X-hydraulic conductivity	1.00
Y-hydraulic conductivity	1.00
specific storage	1.00
elevation of aquifer base	1.00
porosity	1.00
aquifer thickness	1.00

SPACING IN X-DIRECTION

200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
200.00	200.00						

SPACING IN Y-DIRECTION

100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
100.00							

INITIAL FRESH WATER HEADS

.00000

INITIAL FRESH WATER HEADS

.00000

INITIAL INTERFACE ELEVATION

1	2.0000	20.000	20.000	.00000	.00000	-10.000	-10.000	.00000
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
2	2.0000	-10.000	5.0000	-10.000	-20.000	-20.000	-20.000	-10.000
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
3	2.0000	-30.000	-30.000	-20.000	-40.000	-40.000	-50.000	-20.000
	-10.000	.00000	.00000	10.000	10.000	.00000	.00000	.00000
	.00000	.00000						
4	2.0000	-40.000	-40.000	-40.000	-40.000	-50.000	-50.000	-50.000
	-10.000	10.000	10.000	.00000	.00000	10.000	10.000	.00000
	10.000	.00000						
5	2.0000	-50.000	-50.000	-50.000	-50.000	-40.000	-20.000	-50.000
	-10.000	-10.000	-20.000	-20.000	-20.000	-10.000	-10.000	-10.000
	-10.000	-10.000						
6	2.0000	-20.000	-20.000	-30.000	-45.000	-20.000	-10.000	-50.000
	-20.000	-30.000	-30.000	-30.000	-30.000	-20.000	-20.000	-20.000
	-20.000	-10.000						
7	2.0000	.00000	.00000	-10.000	-20.000	.00000	.00000	-40.000
	-50.000	-40.000	-40.000	-30.000	-30.000	-30.000	-30.000	-20.000
	-10.000	-10.000						
8	2.0000	.00000	5.0000	-10.000	-10.000	.00000	.00000	-40.000
	-40.000	-40.000	-30.000	-20.000	-20.000	-10.000	-10.000	-20.000
	-10.000	-10.000						
9	2.0000	.00000	.00000	.00000	.00000	.00000	.00000	-10.000
	-30.000	-10.000	-10.000	-10.000	-10.000	.00000	.00000	.00000
	.00000	.00000						

X-HYDRAULIC CONDUCTIVITY

7	2.0000	.00000	.00000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	-50.000	-40.000	-40.000	.000	-30.000	-30.000	-30.000	-2[illegible]00
	-10.000	-10.000						
8	2.0000	.00000	5.0000	-10.000	-10.000	.00000	.00000	-40.000
	-40.000	-40.000	-30.000	-20.000	-20.000	-10.000	-10.000	-20.000
	-10.000	-10.000						
9	2.0000	.00000	.00000	.00000	.00000	.00000	.00000	-10.000
	-30.000	-10.000	-10.000	-10.000	-10.000	.00000	.00000	.00000
	.00000	.00000						

X-HYDRAULIC CONDUCTIVITY

.46000E-02

X-HYDRAULIC CONDUCTIVITY

.46000E-02

SPECIFIC STORAGE

.17000

ELEVATION OF AQUIFER BASE

1	20.000	20.000	20.000	.00000	.00000	-10.000	-10.000	.00000
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
2	-10.000	-10.000	5.0000	-10.000	-20.000	-20.000	-20.000	-10.000
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						

.17000

ELEVATION OF AQUIFER BASE

1	20.000	20.000	20.000	.00000	.00000	-10.000	-10.000	.00000
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
2	-10.000	-10.000	5.0000	-10.000	-20.000	-20.000	-20.000	-10.000
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
3	-30.000	-30.000	-30.000	-30.000	-40.000	-40.000	-50.000	-20.000
	-10.000	.00000	.00000	10.000	10.000	.00000	.00000	.00000
	.00000	.00000						
4	-50.000	-40.000	-40.000	-40.000	-40.000	-50.000	-50.000	-50.000
	-10.000	10.000	10.000	.00000	.00000	10.000	10.000	.00000
	10.000	.00000						
5	-50.000	-50.000	-50.000	-50.000	-50.000	-40.000	-20.000	-50.000
	-10.000	-10.000	-20.000	-20.000	-20.000	-10.000	-10.000	-10.000
	-10.000	-10.000						
6	-20.000	-20.000	-20.000	-30.000	-45.000	-20.000	-10.000	-50.000
	-20.000	-30.000	-30.000	-30.000	-30.000	-20.000	-20.000	-20.000
	-20.000	-10.000						
7	-10.000	.00000	.00000	-10.000	-20.000	.00000	.00000	-40.000
	-50.000	-40.000	-40.000	-30.000	-30.000	-30.000	-30.000	-20.000
	-10.000	-10.000						
8	.00000	.00000	5.0000	-10.000	-10.000	.00000	.00000	-40.000
	-40.000	-40.000	-30.000	-20.000	-20.000	-10.000	-10.000	-20.000
	-10.000	-10.000						
9	.00000	.00000	.00000	.00000	.00000	.00000	.00000	-10.000
	-30.000	-10.000	-10.000	-10.000	-10.000	.00000	.00000	.00000
	.00000	.00000						

POROSITY

1	.00000	.00000	.00000	.20000	.20000	.20000	.20000	.20000

	-30	10.	1.00	000	00	.	.00	0000
	.00000	.00000						

POROSITY

1	.00000	.00000	.00000	.20000	.20000	.20000	.20000	.20000
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
2	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
3	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.00000	.00000	.20000	.20000	.00000	.00000	.00000
	.00000	.00000						
4	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000						
5	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000						
6	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000						
7	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000						
8	.00000	.00000	.20000	.20000	.20000	.00000	.00000	.20000
	.20000	.20000	.20000	.20000	.20000	.20000	.20000	.20000
	.20000	.20000						
9	.00000	.00000	.00000	.20000	.20000	.00000	.00000	.20000
	.20000	.20000	.20000	.20000	.20000	.00000	.00000	.00000
	.00000	.00000						

FRESH WATER DENSITY 1.000
SALT WATER DENSITY 1.025
FRESH WATER VISCOSITY 1.000
SALT WATER VISCOSITY 1.000

RECHARGE

RECHARGE = .0000

SOURCE/SINK

i	j	QT	WT1	WB
8	9	-.190	-1.00	-45.0
16	8	-.200E-01	-1.00	-20.0
18	8	.000	6.00	-10.0

IDELT = 1 ZMAX = .0000

CONSTANT SALT WATER HEAD NODES

i = 1 j = 1
i = 1 j = 2
i = 1 j = 3
i = 1 j = 4
i = 1 j = 5
i = 1 j = 6

GRID NUMBERS

0	0	0	1	2	3	4	5	0	0	0	0	0	0	0	0
0	0														
6	7	8	9	10	11	12	13	14	0	0	0	0	0	0	0
0	0														
15	16	17	18	19	20	21	22	23	0	0	24	25	0	0	0
0	0														
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
42	43														
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
60	61														

```
i =    1  j =    1
i =    1  j =    2
i =    1  j =    3
i =    1  j =    4
i =    1  j =    5
i =    1  j =    6
```

GRID NUMBERS

0	0	0	1	2	3	4	5	0	0	0	0	0	0	0	0
0	0														
6	7	8	9	10	11	12	13	14	0	0	0	0	0	0	0
0	0														
15	16	17	18	19	20	21	22	23	0	0	24	25	0	0	0
0	0														
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
42	43														
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
60	61														
62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77

ity

78	79														
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	97														
0	0	98	99	100	0	0	101	102	103	104	105	106	107	108	109
110	111														
0	0	0	112	113	0	0	114	115	116	117	118	119	0	0	0
0	0														

INITIAL FRESH VOLUME .89800E+07 CUBIC FEET
INITIAL SALT VOLUME .72800E+06 CUBIC FEET

	FRESH BALANCE RATE (CFS)	FRESH BALANCE TOTAL (CF)	SALT BALANCE RATE (CFS)	SALT BALANCE TOTAL (CF)
CHANGE IN STORAGE	.19158	16553.	-.80519E-01	-6956.8
SOURCE/SINK	.00000	.00000	.00000	.00000
CONSTANT HEAD NODES	.00000	.00000	.79992E-01	6911.3
VERTICAL LEAKAGE	.00000	.00000		
RECHARGE	.00000	.00000	-.65840	
PERCENT ERROR	100.00		-.52667E-03	-45.504
TOTALS	.19158	16553.		
FGN CHANGE IN STORAGE	.17949		-.69979E-01	

STEP NUMBER 30 SIMULATION TIME IN SECONDS .259E+07
IN MINUTES .432E+05

	RATE	TOTAL		
CHANGE IN STORAGE	.19000	16416.	-.50392E-01	-4353.9
SOURCE/SINK	.00000	.00000	.00000	.00000
CONSTANT HEAD NODES	.00000	.00000	.50299E-01	4345.8
VERTICAL LEAKAGE	.00000	.00000		
RECHARGE	.00000	.00000		
PERCENT ERROR	100.00		-.18561	
TOTALS	.19000	16416.	-.93361E-04	-8.0664
EQN CHANGE IN STORAGE	.18992		-.50341E-01	

STEP NUMBER 90 SIMULATION TIME IN SECONDS .778E+07
****
IN MINUTES .130E+06
IN HOURS .216E+04
IN DAYS .900E+02
IN YEARS .247E+00

FRESH WATER HEAD

1	.00000	.00000	.00000	.13297	.51872E-01	-.36955E-01	-.91264E-01	-.15154E-07
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
2	.15210	.20824	.22091	.13328	.46391E-01	-.32489E-01	-.11237	-.18537
	-.40676E-06	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
3	.17127	.21759	.21980	.14452	.50339E-01	-.32189E-01	-.13248	-.23375
	-.28397	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
4	.18250	.22382	.22154	.15207	.61927E-01	-.31493E-01	-.14335	-.32124
	-.32511	-.29221E-05	-.26872E-06	-.22675E-07	-.58738E-07	-.10437E-05	-.10994E-04	-.73939E-04
	-.85382E-05	-.67101E-06						
5	.17964	.22416	.21940	.15303	.71488E-01	-.24995E-01	-.14595	-.41352
	-.38784	-.29811	-.20105	-.11787	-.68518E-01	-.34328E-01	-.18142E-01	-.10990E-01
	-.80235E-02	-.69118E-02						
6	.15640	.21840	.21035	.14075	.70569E-01	-.11771E-01	-.15468	-.54938
	-.48569	-.34332	-.21234	-.12041	-.68318E-01	-.34499E-01	-.18329E-01	-.11129E-01
	-.81081E-02	-.69188E-02						
7	.10347	.21799	.21003	.13222	.78365E-01	.76334E-01	.34497E-02	-.72874
	-.59132	-.37314	-.22482	-.12298	-.68302E-01	-.34600E-01	-.18521E-01	-.11301E-01
	-.80556E-02	-.69147E-02						
8	.00000	.00000	.19404	.12111	.84992E-01	.00000	.00000	-1.0167
	-.66210	-.39609	-.23105	-.12468	-.70580E-01	-.34608E-01	-.17426E-01	-.11260E-01

	.1	.21E	3103	075	[illegible]	[illegible]	.15[illegible]	5493[illegible]
	-.48[illegible]	-.34332	-.21234	[illegible]041	-.88248E-[illegible]	-.3[illegible]E-01	.18[illegible]-01	.11[illegible] 1
	-.81081E-02	-.69188E-02						
7	.10347	.21799	.21003	.13222	.78365E-01	.76334E-01	.34497E-02	-.72874
	-.59132	-.37314	-.22482	-.12298	-.68302E-01	-.34600E-01	-.18521E-01	-.11301E-01
	-.80556E-02	-.69147E-02						
8	.00000	.00000	.19404	.12111	.84992E-01	.00000	.00000	-1.0167
	-.66210	-.39609	-.23105	-.12468	-.70580E-01	-.34608E-01	-.17426E-01	-.11260E-01
	-.80322E-02	-.69108E-02						
9	.00000	.00000	.00000	.12079	.84838E-01	.00000	.00000	-1.4163
	-.74945	-.40180	-.23090	-.12535	-.72854E-01	.00000	.00000	.00000
	.00000	.00000						

INTERFACE LEVEL

1	2.0000	20.000	20.000	.17431E-06	.26466E-06	-10.000	-10.000	-.89934E-14
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
2	-4.0842	-9.0814	5.0000	-10.000	-20.000	-20.000	-20.000	-10.000
	.94237E-13	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
3	-4.8508	-13.904	-22.496	-19.984	-39.938	-39.998	-50.000	-20.000
	-10.000	.00000	.00000	10.000	10.000	.00000	.00000	.00000
	.00000	.00000						
4	-5.3000	-14.500	-24.719	-33.850	-39.174	-49.764	-49.985	-49.999
	-10.000	10.000	10.000	.68859E-14	.15571E-13	10.000	10.000	-.98554E-10
	10.000	-.68308E-12						
5	-5.1857	-14.940	-25.341	-34.966	-43.197	-39.989	-20.000	-50.000
	-10.000	-10.000	-20.000	-20.000	-20.000	-10.000	-10.000	-10.000
	-10.000	-10.000						
6	-4.2558	-13.312	-19.168	-29.810	-44.601	-20.000	-10.000	-50.000
	-20.000	-30.000	-30.000	-30.000	-30.000	-20.000	-20.000	-20.000
	-20.000	-10.000						
7	-1.1078	.35374E-05	-.15071E-06	-10.000	-20.000	-.79373E-06	.10527E-07	-40.000
	-50.000	-40.000	-40.000	-30.000	-30.000	-30.000	-30.000	-20.000
	-10.000	-10.000						
8	2.0000	.00000	5.0000	-10.000	-10.000	.00000	.00000	-40.000
	-40.000	-40.000	-30.000	-20.000	-20.000	-10.000	-10.000	-20.000
	-10.000	-10.000						
9	2.0000	.00000	.00000	.52092E-06	-.89105E-06	.00000	.00000	-44.989
	-30.000	-10.000	-10.000	-10.000	-10.000	.00000	.00000	.00000
	.00000	.00000						

	-10	10.0						
8	2.0000	.00000	5.0000	- 000	-10.000	.00000	.00000	-40
	-40.000	-40.000	-30.000	-20.000	-20.000	-10.000	-10.000	-20.000
	-10.000	-10.000						
9	2.0000	.00000	.00000	.52092E-06	-.89105E-06	.00000	.00000	-44.989
	-30.000	-10.000	-10.000	-10.000	-10.000	.00000	.00000	.00000
	.00000	.00000						

SALT WATER HEAD

1	.00000	.00000	.00000	.12972	.50606E-01	-.27996	-.33294	-.14784E-07
	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
2	.48780E-01	-.18332E-01	.33747	-.11388	-.44254	-.51950	-.59743	-.42475
	-.39684E-06	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
3	.48780E-01	-.12683	-.33424	-.34642	-.92498	-1.0070	-1.3488	-.71586
	-.52095	.00000	.00000	.24390	.24390	.00000	.00000	.00000
	.00000	.00000						
4	.48780E-01	-.13529	-.38677	-.67726	-.89503	-1.2445	-1.3590	-1.5329
	-.56108	.24390	.24390	-.22122E-07	-.57306E-07	.24390	.24389	-.72135E-04
	.24389	-.65464E-06						
5	.48780E-01	-.14569	-.40402	-.70354	-.98385	-.99972	-.63020	-1.6229
	-.62229	-.53474	-.68395	-.60280	-.55465	-.27739	-.26160	-.25462
	-.25173	-.25065						
6	.48780E-01	-.11161	-.26229	-.58977	-1.0190	-.49929	-.39481	-1.7555
	-.96165	-1.0687	-.93887	-.84918	-.79836	-.52146	-.50569	-.49866
	-.49571	-.25065						
7	.73928E-01	.21268	.20491	-.11491	-.41135	.74472E-01	.33655E-02	-1.6866
	-1.7964	-1.3396	-1.1949	-.85169	-.79834	-.76546	-.74978	-.49883
	-.25176	-.25065						
8	.00000	.00000	.31126	-.12575	-.16098	.00000	.00000	-1.9675
	-1.6216	-1.3620	-.95712	-.60944	-.55666	-.27767	-.26090	-.49879
	-.25174	-.25064						
9	.00000	.00000	.00000	.11784	.82769E-01	.00000	.00000	-2.4791
	-1.4629	-.63590	-.46917	-.36620	-.31498	.00000	.00000	.00000
	.00000	.00000						

WATER QUALITY MAP: 0=FRESH, 1=MIX, 2=SALT

9 9 9 0 0 0 0 2 9 9 9 9 9 9 9 9 9
1 1 2 0 0 0 0 0 2 9 9 9 9 9 9 9 9

	.00							
2	.48780E-01	-.18332E-01	.33747	1388	-.44254	-.51950	-.59743	-.4 5
	-.39684E-06	.00000	.00000	.00000	.00000	.00000	.00000	.00000
	.00000	.00000						
3	.48780E-01	-.12683	-.33424	-.34642	-.92498	-1.0070	-1.3488	-.71586
	-.52095	.00000	.00000	.24390	.24390	.00000	.00000	.00000
	.00000	.00000						
4	.48780E-01	-.13529	-.38677	-.67726	-.89503	-1.2445	-1.3590	-1.5329
	-.56108	.24390	.24390	-.22122E-07	-.57306E-07	.24390	.24389	-.72135E-04
	.24389	-.65464E-06						
5	.48780E-01	-.14569	-.40402	-.70354	-.98385	-.99972	-.63020	-1.6229
	-.62229	-.53474	-.68395	-.60280	-.55465	-.27739	-.26160	-.25462
	-.25173	-.25065						
6	.48780E-01	-.11161	-.26229	-.58977	-1.0190	-.49929	-.39481	-1.7555
	-.96165	-1.0667	-.93887	-.84918	-.79836	-.52146	-.50569	-.49866
	-.49571	-.25065						
7	.73928E-01	.21268	.20491	-.11491	-.41135	.74472E-01	.33655E-02	-1.6866
	-1.7964	-1.3396	-1.1949	-.85169	-.79834	-.76546	-.74978	-.49883
	-.25176	-.25065						
8	.00000	.00000	.31126	-.12575	-.16098	.00000	.00000	-1.9675
	-1.6216	-1.3620	-.95712	-.60944	-.55666	-.27767	-.26090	-.49879
	-.25174	-.25064						
9	.00000	.00000	.00000	.11784	.82769E-01	.00000	.00000	-2.4791
	-1.4629	-.63590	-.46917	-.36620	-.31498	.00000	.00000	.00000
	.00000	.00000						

WATER QUALITY MAP: 0=FRESH, 1=MIX, 2=SALT

```
9 9 9 0 0 0 0 2 9 9 9 9 9 9 9 9 9 9
1 1 2 0 0 0 0 0 1 9 9 9 9 9 9 9 9 9
1 1 1 1 1 0 0 0 0 9 9 2 2 9 9 9 9 9
```

```
1 1 1 1 1 1 1 0 0 2 2 2 2 2 2 2 2 2
1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0
1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0
9 9 2 0 0 9 9 0 0 0 0 0 0 0 0 0 0 0
9 9 9 0 0 9 9 0 0 0 0 0 0 9 9 9 9 9
```

APPENDIX 3-4B – HOTEL WATER CONSERVATION STUDY

Hotel Water Conservation

A Seattle Demonstration

Prepared for:

Seattle Public Utilities
Resource Conservation Section

By:

O'Neill & Siegelbaum and
The RICE Group

July 2002

Seattle Public Utilities (SPU) would like to thank the project team, which collaborated with SPU during the course of this project.

Project Manager:

Philip Paschke
Seattle Public Utilities
710 Second Avenue
Seattle, WA. 98104
(206) 684-5883
phil.paschke@ci.seattle.wa.us

Engineering Analysis:

Roger E. van Gelder, P.E.
The RICE Group
19015 35th Avenue West, Suite A
Lynnwood, WA. 98036
(425) 774-3829

Behavioral, Education and Industry Analysis:

Heidi Siegelbaum
O'Neill & Siegelbaum
3018 NW 85th Street, Suite 5
Seattle, WA. 98117
(206) 784-4265
wastenot@speakeasy.org

Terms used in this report:

GPM is gallons per minute and is the unit used to express instantaneous water use.

GPF is gallons per flush and is the unit used to express water use per toilet or urinal flush

GPD is gallons per day and is the unit used to express water use for an identified function over a 24-hour period.

CCF is one hundred cubic feet of water and is equal to 748 gallons.

Cycles of concentration is a measure of the water efficiency of a cooling tower and is the ratio of total water used by the tower vs. water sent to waste. It is commonly computed by dividing the conductivity reading for the sump water by the conductivity reading for the incoming (makeup) water.

Executive Summary

I. Purpose: The purpose of the Hotel Water Conservation Pilot was to evaluate the effectiveness of combining an engineering approach with a behavioral/educational approach and to identify water use patterns and opportunities for water conservation in a selection of Seattle hotels. The project was sponsored by Seattle Public Utilities (SPU) which, in collaboration with its wholesale water partners, provides water to over 1.3 million people and businesses within its service boundaries.

The hotel sector is an attractive target for water conservation for several reasons:

1. The lodging sector, representing less than 1% of commercial accounts, consumes approximately 5% of commercial water in SPU's service area.
2. The Pacific NW is a receptive market for emerging sustainable practices.
3. Hotels are very recognizable to the public and are sensitive to public perception.
4. A sector approach addresses many of the barriers associated with broadly cast conservation strategies covering unrelated industries.

II. National Survey and Case Study Review: The project team identified water conservation measures and behavioral approaches to water conservation, or efficiency, from a representative sample of U. S. lodgings in a national literature and telephone survey. This data indicated that a majority of lodgings had adopted some combination of measures to reduce water consumption, including low flow fixtures, towel-linen exchange programs, ozone laundry systems and staff education and outreach. In some cases, such as The Colony Hotel in Kennebuncport, Maine, water conservation was adopted in the context of a rigorous sustainability platform in which every aspect of the hotel's operation was guided by environmental criteria and decision points.

The project team also reviewed available literature in order to collect baseline data on hotel water use, identify factors associated with increased water use at specific hotels, and collect information on conservation measures proposed for a variety of hotels along with associated savings potential. Total water usage across a wide variety of hotels ranges from under 100 gallons per day per room (gpd/rm) to over 400 gpd/rm. Older, luxury hotels and hotels with full service restaurants and on-site laundry facilities typically exhibit the highest water usage per room. Identified savings potential varied from between 0% - 45% of total usage, with between 10% - 20% taken as typical. (See Case Study Review contained in *Appendix 1*).

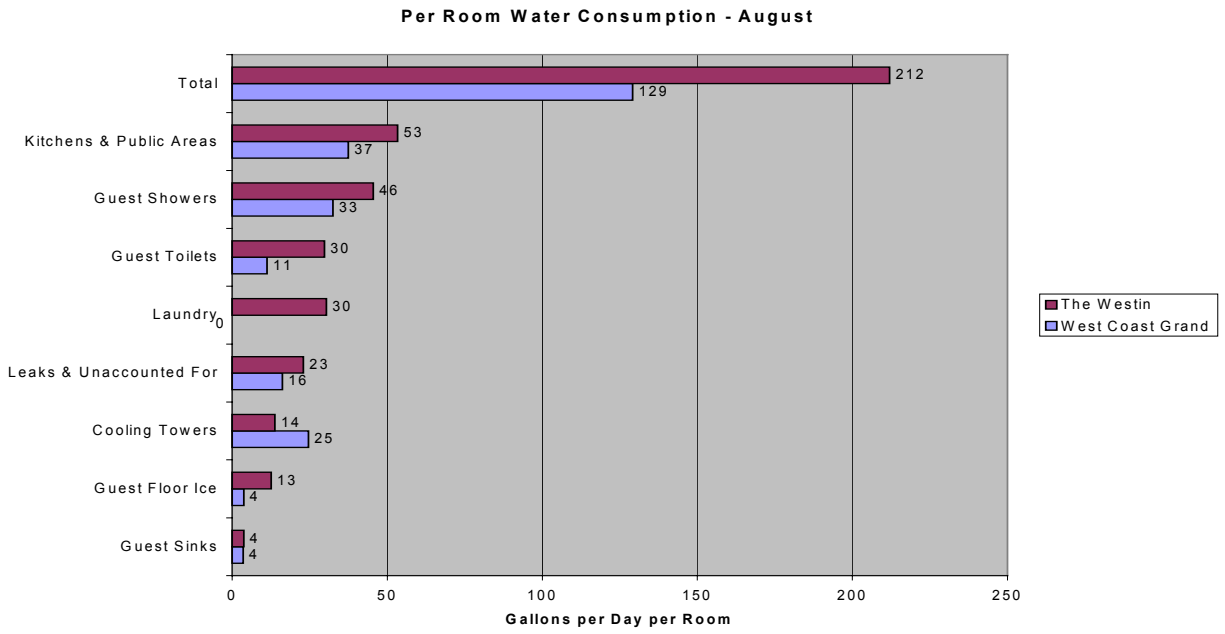
III. Seattle Survey: A local telephone survey was conducted to assess the approach, measurement, and culture of water conservation in area hotels. The surveyed hotels in the sample represented 40% of the selected field (hotels with over 75 rooms) and 25% of all Seattle hotels, the latter of which includes all Seattle hotels regardless of room size. A majority of the hotels surveyed stated they had installed some combination of water conserving measures in the last five years, including 31% that had adopted the well known towel-linen exchange program in which multiple night guests are given the option of not having towels and linens laundered daily.

Ninety percent of the hotels stated they had installed faucet aerators or restrictors and low flow showerheads, while only 50% stated they had installed low flow toilets. Air-cooled ice machines were used in 60% of the surveyed hotels. Only 5% had what they considered to be efficient commercial dishwashers.

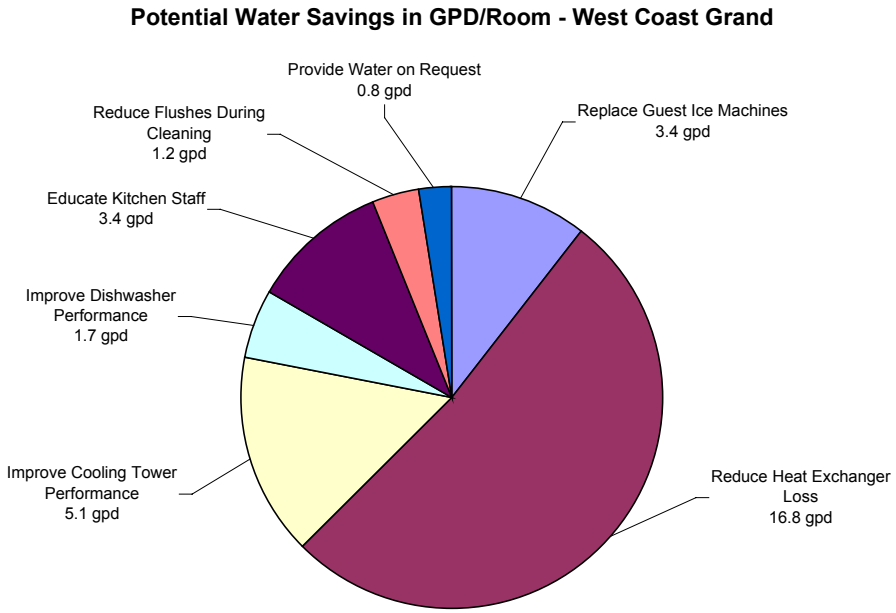
IV. Audit Selection: To facilitate the partnership nature of this project, SPU drafted a Participation Agreement that the participating hotels were asked to sign. Of the twenty hotels with compiled profiles, six were chosen for initial selection based on conservation potential. Factors considered to assess conservation potential included average gpd/room, number of hotel rooms, investment criteria used by the parent corporation, and willingness to participate. After an extensive evaluation and consultation process, the Westin Hotel and the West Coast Grand (WCG) agreed to participate in the pilot.

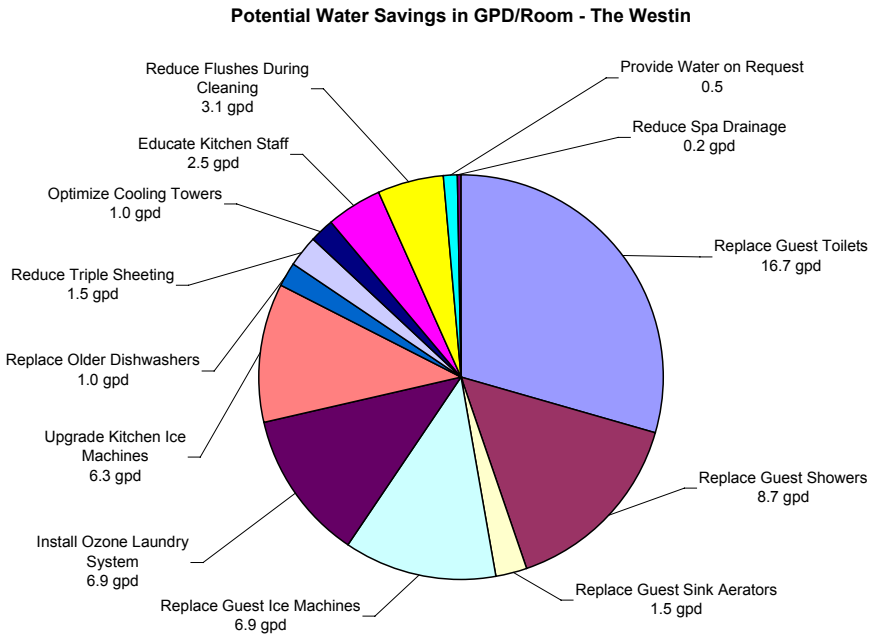
V. Combined Engineering and Behavioral Evaluation: The pilot program investigated water conservation opportunities related both to "Equipment Measures" involving replacement or significant upgrades to existing equipment, and "Behavioral Measures" related to equipment maintenance and to employee/guest education. Many commercial water conservation studies have focused primarily on equipment measures only. However, without adequate employee education and establishment of regular maintenance schedules, water savings projected for equipment replacements may easily be lost or overshadowed.

VI. Findings and Recommendations: Overall water use patterns for the two study hotels fell within the expected range. The Westin, which is an older hotel complete with in house laundry and a variety of banquet and restaurant facilities but with no site irrigation, consumed approximately 212 gpd per room during the August study period. The West Coast Grand, which is a newer facility with low flow toilet fixtures, banquet and restaurant facilities, but no in house laundry consumed 129 gpd per room.


Per Room Water Consumption - August
Total
Kitchens & Public Areas
Guest Showers
Guest Toilets
Laundry
Leaks & Unaccounted For
Cooling Towers
Guest Floor Ice
Guest Sinks
212
129
53
37
46
33
30
11
30
0
23
16
14
25
13
4
4
4
0
50
100
150
200
250
Gallons per Day per Room
The Westin
West Coast Grand

Substantial water conservation opportunities were identified. Many of these water conservation opportunities also provide opportunities for energy conservation. For each of the two hotels audited, potential water savings equaled approximately one-third of current water consumption. For the older Westin Hotel, close to 90% of the projected savings were from equipment measures primarily related to upgrades to restrooms, ice machines and laundry equipment. For the West Coast Grand Hotel, a converted office building, close to 90% were for "behavioral" measures, primarily related to maintenance and operation of heating and cooling equipment.





A. *Equipment Measures*: Considerable water conservation opportunities were identified through replacing or substantially upgrading older equipment. After utility incentives are factored in, most of these upgrades could be made with a simple payback of two years or less. The most significant equipment measures include:

- *Guest Room Toilets*: Replace older 3.5 gpf toilets with more modern 1.6 gpf models. In addition to excessive flush volumes, individual floor metering revealed significant water loss attributed to leaking flappers.

- *Guest Showers*: Replace older 3.5 gpm showerheads with models using 2.5 gpm or less. The Westin Hotel tested 1.75 gpm models on one floor with excellent results.

- *Faucet Flow Restrictors*: Replace existing 2.5 gpm & 3.0 gpm faucet aerators with 1.5 gpm or lower aerators. These lower flow aerators also result in less splashing and associated cleanup, with no discernable difference to the guest. Install 2.5 gpm in-line flow restrictors in kitchen prep sinks commonly used for thawing and rice washing.

- *Single Pass Water-Cooled Ice Machines*: Replace existing water-cooled ice machines or connect to an existing cooling water recirculation system.

- *Laundry*: Install ozone systems and/or rinse water recycle system to reduce laundry water and associated water heating and chemical use.

- *Dishwashers*: Replace inefficient dishwashers with water conserving models. This measure may only be cost effective for dishwashers which are already nearing the end of their expected life.

B. *Behavioral Measures:* In addition to equipment replacement, a number of measures were identified relating to maintenance and other behavioral changes. The most significant behavioral measures include:

- *Toilet Leaks*: Significant sources of leakage were discovered related to deteriorated toilet flappers. Implement a regular toilet flapper replacement schedule.

- *Steam Heat Exchangers*: Install sub-meters on cold water feed lines to all heat exchangers. Regularly log readings and make repairs to heat exchangers as necessary.

- *Other Sub-metering*: Install sub-meters for other significant water consuming operations including dishwashers, pools and spas, laundry, irrigation, and kitchens. Log usage and perform maintenance as necessary to reduce waste.

- *Cooling Towers*: Cooling towers were not being operated at optimum levels. Conductivity readings should be recorded at least weekly. Cooling tower controls should be upgraded as necessary and set to maintain cycles of concentration near 10. Cooling tower maintenance contracts should be amended to ensure the water treatment service provider maintains the target cycles of concentration.

- *Food and Beverage*: Significant excess use was observed in kitchens where continuously running water, often for hours at a time, was used for thawing frozen food and washing rice. Educate kitchen staff regarding correct methods for thawing frozen food and rinsing rice. Frozen food may be thawed in a refrigeration unit and sushi rice should be agitated in a colander. Additionally, sub-metering of kitchen use and back charging costs to the kitchens could help raise awareness among kitchen managers of wasteful practices.

- *Housekeeping*: Publicize towel-linen programs. Educate custodial staff to reduce number of times toilet is flushed during room cleaning.

C. *Continuing Program Developments in Participating Hotels*: During delivery of the project services, the Westin Hotel adopted a towel-linen program. The West Coast Grand Hotel strengthened their delivery of an existing towel-linen program, began to serve water only on request, developed a food donation program, and is working with Seattle City Light to upgrade its energy systems. Starwood Hotels and Resorts Worldwide, Inc., of which the Westin is an affiliate, is in the process of developing an environmental policy and has begun to utilize performance contracting in their implementation of resource conservation projects.

D. *Corporate Environmental Management*: Neither hotel has drafted and implemented a written environmental policy promoting water conservation, although both hotels are under

pressure to respond to budgeting constraints and have adopted water conservation measures. Industry trends and pressures tend to promote "over service" in which quantity and embellishment prevails over tailored service.

It is recommended that both hotels adopt a more broadly cast sustainability program, based on overarching systems frameworks such as The Natural Step (www.thenaturalstep.org), within which to surround their water and other resource conservation efforts. Such a program would require:

- Corporate program adoption,
- Support from upper management, including the CEO, CFO and Board of Directors
- Reporting out to investors regarding adoption and progress, using performance measures
- Environmental criteria written into job descriptions and performance standards
- Adoption of incentive systems to promote conservation measures. Outreach to guests
- Urge chemical suppliers to eliminate certain constituents from cleaning products such as phosphates, SARA 313 listed chemicals, Alkylphenol ethoxylates (APEs) and corrosive substances.

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1.0 Background and Approach

From April 1999 through April 2001, Seattle Public Utilities (SPU) and its consultant team conducted a Hotel Water Conservation Pilot Project in Seattle, Washington. The purpose of the study was to evaluate the effectiveness of combining an engineering with a behavioral, educational, and organizational analysis to reduce water consumption in the participating hotels, and to provide a potential roadmap for other area hotels to utilize in their resource conservation efforts. A further goal was to determine end uses by equipment and behavior for both guests and employees.

For several years SPU has **sponsored** ongoing water conservation programs in the commercial/industrial sector. The programs have approached the sector with a broad message of efficiency, while at the same time have focused **primarily** on large water users. For this pilot project SPU pursued a **tailored** hotel sector approach based on the likelihood that sector-based approaches are more efficient in changing industry standards, normative values and conduct. The Environmental Protection Agency (EPA), Washington State Department of Ecology, and King County Department of Natural Resources have all successfully used sector- based approaches to environmental management. SPU was also looking at the benefits of having a detailed breakdown of end uses in the evaluation of efficiency opportunities in a wide number of hotels.

The hotel sector was chosen based on several factors:

- The lodging sector, representing less than 1% of commercial accounts, represents approximately 5% of commercial water use in SPU's service area.
- The Pacific Northwest is a receptive market for emerging sustainable practices.
- Sustainable tourism is rapidly accelerating worldwide and water conservation is an easy "low-hanging fruit" approach to baseline strategies.
- A sector approach addresses many of the barriers associated with broadly cast conservation strategies covering unrelated industries.

The project team examined the trends, issues of interest, organizing principles, culture, barriers and opportunities to change and trust sources. The team conducted extensive analysis of the hotel sector, contacting international, national and local trade associations, academic institutions, individual hotels, suppliers, certification organizations, non-governmental organizations and EPA programs devoted to sustainable tourism and water conservation. The team also evaluated how water conservation programs might be incorporated into larger sector-based environmental management and sustainability platforms, to increase efficiency and reduce overall natural resource impacts. From April through early July 1999, the project team conducted a national survey of water conservation measures adopted by hotels. A partial list of contacts is included in *Appendix 2.*

The team then evaluated the Seattle lodging market, comprised of hotels with 75 rooms and over. A telephone survey was developed to ascertain which practices Seattle hotels were using to conserve water and addressed issues pertaining to corporate culture, investment

criteria, physical plant and the manner in which billing was handled. Completed survey forms are found in *Appendix 3*.

From the results of the Seattle survey instrument, the team prepared a rough spreadsheet analysis of water use per room prior to selection. Six hotels were then identified as possible candidates for the project. A project of this scope and intensity would require that the selected hotels make available books and records, access to staff and exhibit a willingness to adopt conservation measures in the hotel. The hotels were selected based on:

1. Water conservation potential
2. Willingness to participate
3. Age and condition of physical plant
4. Hotel size and features
5. Whether it was part of a larger company in which adopted measures could be replicated in other properties
6. Payback and investment criteria that would enable the hotel to adopt conservation measures in the next several years

Participation Agreement

The team either personally visited each hotel or spoke extensively with its General Manager regarding participation. Agreement was then made with two hotels for participation in the project. What differentiated this project from many others is that SPU required the participating hotels to sign a bilateral Participation Agreement. This hoped to ensure the participating hotels continued cooperation in the projects methodology which included shadowing and meeting with hotel employees.

Among other things, the agreement requires the project hotels make every effort to:

(i) Implement water conserving hardware and educational programs.
(ii) Implement at least one recommendation annually for the three years following the close of the project.

These will be implemented in accordance with SPU's recommendations as contained in this report and in accordance with the hotel's budget, investment criteria and availability of funds.

Site Visits

Following signing of the participation agreement, a number of site visits were made to each hotel over the course of the project to survey equipment, measure flow to various pieces of equipment and processes, shadow housekeeping and kitchen staff, and meet with representatives from engineering, food & beverage, housekeeping, and laundry operations. Historical billing data was reviewed and an end use allocation calculated. Water conservation measures were then developed and evaluated, including both "equipment measures" and "behavioral measures."

2.0 RESEARCH FINDINGS

2.1 National Survey

From April through early July 1999, the project team conducted a national survey of water conservation measures adopted by hotels. Over 47 hotels, hotel associations, non-profits, suppliers, academic institutions and water authorities were contacted throughout the United States. EPA has several standing programs that address sustainable tourism including the WAVE program- Water Alliances for Voluntary Efficiency (Office of Water)- and EPA's Sustainable Travel and Tourism Program (Office of Policy, Industry Sector Policy Division). They were able to provide additional leads, including hotel properties that were actively engaged in these programs.

Contacts were made through e-mail, telephone calls, and trade associations to secure additional resources. The contacts made are a representative sample of organizations involved in hotel water conservation, but by no means are a comprehensive sample for the United States.
A partial contact list in included in *Appendix 2*.

A. Purpose

The purpose of the survey was to develop a broader understanding of what behavioral approaches were used to reduce hotel water consumption. Of the surveyed organizations, the following approaches were used to promote water conservation:

B. Findings

1. *Policy development:* Several hotels, including La Quinta Inns, Holiday Inns, Hyatt and boutique hotels such as the Boston Park Plaza and Colony Hotel, had adopted water conservation policies. In the case of The Colony Hotel, water conservation programs are developed in the context of more developed sustainability or environmental management plans that involve Ecology Groups (in-hotel green teams responsible for addressing environmental issues and tracking progress), membership in Businesses for Social Responsibility and where the hotel actively promotes its programs.
2. *New Staff Orientation:* Training materials, meetings and employee manuals clearly state the water and other conservation policies of the hotel.
3. *Communication in-house:* Newsletters, bulletin boards, flyers, paycheck stuffers and meetings were all used to discuss water conservation.
4. *Communicating to the public:* Several hotels used their websites, advertising and sales materials to communicate with current and prospective guests about water and other conservation efforts. In many hotels, this is accomplished through towel-linen notices, and in-room reminders to turn off lights and faucets. In the case of the Colony Hotel, sales and marketing packets contain the hotel's *Environmental Responsibility Program,* which includes goals, activities, outcomes and projects.

5. *Incentives:* Several hotels use cash bonus incentives to reduce water use. La Quinta Inns has capitalized on, and motivated staff and managers by advertising their awards, including those received by the American Water Works Association.
6. *Measurement:* Surveyed hotels used a combination of approaches including formal leak detection programs, metering, hiring companies to identify rate errors, and reviewed the water and related bills in-house. A surprisingly large number of hotels review these bills at the corporate offices or comptroller offices, almost always physically removed from the hotel property. Establishing goals and water reduction targets by department, process, and staff function is critical to successful water conservation.
7. *Continuous Improvement:* Related to measurement, many hotels used engineering, cross-departmental and Ecology groups to monitor progress and make programmatic adjustments every quarter. Goal and target setting is essential to tracking improvement.

2.2 Engineering Case Study Review

The team reviewed literature and contacted several municipal and private organizations collecting data from the Greater Vancouver Regional District, American Hotel & Motel Association, Los Angeles Department of Water and Power, East Bay Municipal District and several local water utility studies.

A. Purpose

The purpose of the engineering case study review was to review available literature concerning water conservation opportunities for hotel properties to:

- Collect baseline data on hotel water usage
- Identify factors associated with increased water usage at specific hotels
- Collect information on water conservation measures proposed, with concomitant savings potential
- Provide insight regarding the most useful information that could be gathered by the pilot program

B. Findings

Total water usage across a wide variety of hotels range from under 100 gallons per day/room (gpd/room) to over 400 gpd/rm, with a median range between 144 and 190 gpd/rm. Hotels rated as larger, older, or luxury had median usage close to 250 gpd/rm. Hotels with full service restaurants, large irrigated areas, and on-site laundry facilities typically exhibit the highest water usage per room. Water conservation measures identified as having the highest savings potential include:

- Retrofit or replacement of non-water conserving toilets and urinals
- Replacement of showerheads with low flow models
- Installation of faucet aerators

- Elimination of once-through cooling
- Laundry water recycle
- Dishwasher upgrades
- Leak repair
- Education of staff and guests in water conservation opportunities

Identified savings potential also varied widely, from 0% to 45% of total usage, with between 10% and 20% taken as typical. However, very little documentation was provided regarding actual savings realized. In addition, although process use improvements for cooling, laundry, and kitchen use were occasionally identified as having substantial potential, attention was not consistently given to this potential, or to the potential provided by leak detection and repair. These shortcomings may be largely attributed to the lack of sub-metering data necessary to highlight savings potential in process (non-domestic) usage, as well as a system by which to set targets, performance measures and outcomes from efficiency measures.

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The full case study report can be found in *Appendix 1.*

2.3 Seattle Survey

Using a telephone survey method, the team evaluated the Seattle lodging market comprised of hotels with 75 rooms and over. These hotels would collectively have a more significant impact on water use in the City of Seattle, and in many cases represent the most visible in terms of name recognition. The telephone survey was developed to ascertain which practices Seattle hotels were using to conserve water and addressed issues pertaining to corporate culture, investment criteria, physical plant and the manner in which billing was handled. The completed survey forms can be found in *Appendix 3.*

The surveys took one month to conduct and of the 60 hotels selected, 22 responded to the questionnaire. Questions were categorized as follows:

1. Billing
2. Water Conservation Measures Adopted
3. Water use inventory by department (guest rooms, engineering, Food and Beverage, irrigation, Cooling/HVAC, laundry)
4. Meter use
5. Physical Property characteristics
6. Corporate Culture and Norms
7. Investment criteria
8. Willingness to adopt additional conservation measures

2.3.1 Survey Participation

The following hotels participated in the survey:

1. Best Western Executive Inn

2. Courtyard Marriott
3. Crowne Plaza
4. Days Inn Town Center
5. Edmond Meany Hotel
6. Hotel Seattle
7. Madison Renaissance Hotel
8. Paramount Hotel
9. Ramada Inn Northgate
10. Seattle Inn
11. Sheraton Towers
12. Sixth Avenue Inn
13. The Edgewater
14. The Roosevelt
15. The Warwick Hotel
16. The Westin Hotel
17. Travelodge
18. University Inn
19. W Hotel
20. West Coast Grand Hotel
21. The Alexis Hotel
22. The Four Seasons

The results of the survey were used to create a field of hotels appropriate to participate in the project.

2.3.2 Survey Findings

A. Measures Adopted

A majority of the hotels surveyed stated they had installed some combination of water conserving measures in the last five (5) years, including six, or 31%, that had adopted the well known towel-linen program in which guests are given the option of not having their towels and linens laundered daily. Ninety percent of the hotels stated they had installed faucet aerators and low flow showerheads, while only 50% had installed low flow toilets in guest rooms. Only 35% of the surveyed hotels stated they had installed low flow urinals in public restrooms although 65% had installed faucet aerators in this part of the hotel. Air-cooled ice machines were used in 60% of the surveyed hotels, although only 5% had what they considered to be efficient commercial dishwashers.

Twenty-five percent, or five (5) hotels, had adopted gray water reclamation or wash and rinse reuse systems (in which the water from the last rinse cycle is stored, filtered and then re-used in a subsequent wash cycle for first rinse). The same percentage of hotels also used what they considered to be high-efficiency commercial dishwashers. These hotels did not necessarily adopt both measures, but either one or the other.

A very small number had adopted or had knowledge of using thawing policies in which frozen foods are thawed in a walk-in refrigerator rather than continuously running water over the food to thaw. This could have significant implications for those hotels serving over 1 million meals a year (large convention and banquet operations).

B. Knowledge of, and measuring water conservation potential

A significant number of the hotel staff and managers were not trained specifically in conservation techniques and measures. Ninety percent did not know or did not have access to cost saving data correlating to the water conservation measures already adopted. Related to this finding, none of the surveyed hotels knew, by department or function, how much water was being used and 55% did not have submeters or deduct meters in the hotel.

C. Ownership and culture

Most of the surveyed hotels, or 85%, are part of larger holding companies, real estate investment trusts (REITs), joint ventures, corporate affiliates, or franchises. The trend in many of these companies, including Starwood Hotels & Resorts Worldwide, Inc. (Starwood), Host-Marriott Corporation and the Kimpton Group, is to purchase existing structures and renovate them rather than starting new construction projects. Accordingly, there may be more serious barriers to installing efficient water conserving measures due to the age, original condition or use of the building.

In addition, many of these hotels are publicly traded so there is considerable pressure to provide an attractive return on investment. Most of the hotel's parent corporations clearly state that their primary business objective is to acquire high quality assets with potential for significant capital appreciation, and to maximize earnings and cash flow. The challenge is to educate the hotels regarding the value of natural capital and the financial and environmental benefits of conservation and efficiency, thereby leading to increases in net operating profits.

Only 26% of the surveyed hotels believed that their parent corporations or joint ventures had a written environmental policy or action plan, although several stated that conservation was integral to their property's overall goals. Several of these companies, notably Hilton, Marriott and Starwood, belong to the International Hotels Environmental Initiative (IHEI) with offices in London, so they already have an environmental policy or presence in overseas operations. Whether these policies "trickle down" to individual properties and policies is unclear.

When asked how certain factors or conditions rated when considering whether to adopt water conservation measures, the overwhelming majority were motivated by knowing their actions are important to the community. 75% acknowledged the inherent value in water as well as the limitations imposed by municipal water storage capacity. Less than half (45%) believed the trend towards "green tourism" or value-based purchasing was important in making water conservation decisions, and 70% were motivated by utility rebates.

D. Financial Decision Making

Over half of the engineers surveyed were not familiar with the hotel's investment criteria, but the majority of those who did know used a payback period between 1 and 3 years, with three using 2-2.5 year payback, three using 1-year payback, and one each using 3 and 7-8 year payback periods. Capital limits were reported as variable depending on where the investment fit into priority based budgeting, available funds, competing interests, occupancy rates and other exigencies. Several reported having unlimited capital funds for water conservation projects but an equal number reported having to secure parent corporate approval for capital improvements of any dollar amount.

When reported, capital budgets ranged from $500 to over $20,000, while several chose to maintain confidentiality regarding such figures. 50% of the surveyed hotels reported having funds available to adopt water conservation measures and 60% had space and willingness to beta-test equipment in one or more of their rooms.

E. Conclusions

A majority of the surveyed hotels were generally familiar with water conservation measures, but were unable to more particularly characterize water use within each department or function, or to measure cost savings associated with such measures. Since most of the surveyed engineers had not received specific water conservation training, their hotels would benefit from receiving more specific information regarding available technology and performance parameters, distributors and cost savings associated with each conservation measure.

In particular, these hotels need more information and help to identify areas of greatest water use, and in using software and other tools designed to measure cost savings. These findings in turn can be used to more accurately forecast, budget and set priorities for capital investments, and communicate to managers and investors.

2.4 Recommendations for Further Research

A recurring theme during the project was the need to conduct focus groups. To facilitate acceptance of water conservation approaches involving the guest, it is essential for the hotels to have a better understanding, and hence comfort level, regarding client acceptance of hotel conservation programs.

Focus groups are meetings held in casual settings with self-selected individuals in which ideas, opinions and issues are discussed. In some cases, one-way mirrors are used and the results are used to shape an organization's policies, approach and implementation to any range of issues. Because the format is discussion based rather than a linear written survey, the researcher can clarify on what basis a person expresses an opinion, or why they would take certain action.

The project team recognized the value focus groups would add to the project. Goals, expected accomplishments, screening questions, and a public notice were developed. Given time and budget constraints on the project however, actual sessions were not held.

Nevertheless, the overall reticence regarding direct communication with guests about conservation issues underscores a fear that environmental initiatives, if shared too directly with the guest, will be a nuisance rather than an enabling opportunity. Given this, a series of focus groups with both actual and characteristic leisure and business guests would provide a better sense of how guests respond to hotel environmental initiatives and the ideal manner in which they are shared with the guest. Focus group results would enable hotels to tailor their communications strategies for water conservation, as well as other environmental issues and subsequent program development.

3.0 OUTREACH EFFORTS

During the course of the project, the team used a variety of educational approaches to water conservation directed towards hotel management and staff. Understanding that the provision of information is rarely enough to change behavior, it is nonetheless the first step that must be taken to facilitate a water conservation ethic, as well as a change in knowledge and attitude.

3.1 Promotion of Towel-Linen Program

There are approximately 26,000 hotel rooms, including B & Bs, in the Seattle and King County area. In downtown Seattle there are 9,655 rooms, the area defined north/south as falling between the Space Needle and Pioneer Square. [1]

Towel-linen programs were one of the first attempts by the US hotel industry to reduce environmental impact and have been a relatively easy and successful way in which to reduce the 180 billion gallons of water used each year by US hotels. [2] The US EPA has now joined the American Hotel and Motel Association (AH&MA) to develop the *Good Earthkeeping* program that developed in-room guest cards and promotional content to facilitate water conservation through these programs. It is estimated that over 3,400 hotels in the US offer towel-linen programs.

The program tends to be the most successful with business travelers who are accustomed to hotel life, who typically do not spend much time in their rooms and who may be more familiar with the more aggressive European conservation initiatives adopted by the tourism industry. In an interview with *Lodging* magazine, Ron Berger of the Sheraton Rancho Cordova, remarked that even with a conservative 25% participation rate in the program, the hotel's utility costs had dropped 5%. [3]

Guest response to towel-linen programs: Perceived guest response has been a barrier to program adoption by certain hotels. The project team found that several larger hotels in the Seattle market declined to adopt the towel linen program because they believed that such programs were not commensurate with luxury service, or the level of service expected from a luxury

line. However, interviews with the regional public affairs manager for the Fairmont Banff Springs Hotel in Alberta, Canada revealed that their luxury hotels, in which rates could exceed $700/night, encountered very few problems with the corporation's towel-linen program. [4]

At the same time US hotels were beginning to consider towel-linen programs, surveys were conducted to assess guest reaction to towel-linen programs. A 1994 study revealed that over 87% of the guests surveyed appreciated a towel reuse program, while only 5.2% did not. [5] A majority of those surveyed indicated they would like to see this option offered on an industry-wide basis, and expanded to include sheets. Guests responding to the survey also indicated they would be comfortable using the same sheets for over 3 days and towels 2. 5 days. [6]

Of the hotels having adopted towel-linen programs, all housekeeping staff responded that guests were very supportive of the programs and in one instance, guests had complained when there *didn't* appear to be a program in place at the time of the complaint. The largest hotel having adopted such a program is the Sheraton Hotel with 840 rooms, and in descending order, West Coast Grand (300), the Hotel Edgewater (239), Marriott Residence Inn Lake Union (234), Warwick Hotel (229), Hampton Inn and Suites (198), Holiday Inn Express (195), Hotel Monaco (189) and the Ramada Inn at Northgate (169). During the course of this project, the Westin Hotel, with 891 rooms, also adopted a towel-linen program, and in fact was warmly received.

With the exception of the West Coast Grand, the Sheraton Hotel, and the Westin, most of Seattle's hotels with 300 rooms and over have not adopted a towel-linen program. Discussion with both engineering and housekeeping staff, as well as research conducted in other projects indicates a variety of reasons for not adopting towel-linen programs. These include:

1. Fear that guests will complain;
2. Management interprets the towel-linen program as being "cheap;"
3. Housekeeping values daily washing as part of its excellence in service;
4. Previous guest complaints;
5. Program was instituted in the past without proper accompanying materials explaining the basis for program adoption;
6. Corporate policy against towel-linen programs;
7. Belief that daily linen service is commensurate with room price.

During the pilot, the project team gave presentations to several hotel's housekeeping and laundry staff regarding the procedures and benefits of towel-linen programs. See *Appendix* 5 for supporting materials that were distributed to the hotels. Of great importance is the manner in which the program is introduced to both staff and guests, and the language used on the towel-linen cards. There are a wide range of cards that can be purchased commercially, and some hotels have designed their own graphic layouts.

Issues to consider when developing a towel-linen program are:

1. Distribute question and answer fact sheet to every department, including national sales and reservations offices, setting forth the basis, benefits and attributes of the program. This will ensure the entire staff and corporate offices are well informed and working from the same level of understanding.
2. Incorporate program discussion into new staff orientation and employee manuals. Retrain all housekeeping and laundry staff to ensure acceptance and understanding.
3. Translate towel-linen cards into languages that tend to be represented in the hotel, including those of both staff and guests.
4. Identify a champion or leader within housekeeping to keep the program invigorated and with high participation, including responses that will graciously acknowledge the complaint yet support the program.
5. Discuss and map out the process by which guest compliments and complaints will be handled with respect to the program.

Towel-linen program adoption can be based on the following principles:

1. There are cost savings in water, sewer, heat, chemicals, staff time and life of linens.
2. Even though it appears to rain frequently in Seattle, water conservation is an essential strategy, particularly during a drought. Rainfall does not equal potable (drinking) water.
3. If water storage capacity is exceeded, new sources have to be acquired at great expense, if possible. This will lead to increasing pressure to raise water rates.
4. Salmon Endangered Species Act (ESA) listings, among other factors, already limit future water supplies.
5. Guests support these programs and there is ample evidence of their acceptance. (A Holiday Inn study indicates over 80% of their business and leisure travelers were more inclined to stay at a place where a towel-linen program was in place.)
6. These programs are a simple, voluntary way to save money and show your guests that you care about your community.

Notes

1.Conversation with the News Bureau, Seattle-King County Convention and Visitors Bureau
2. EPA Office of Water and the American Hotel & Motel Association
3. *Lodging Magazine,* February 1994, p66
4. Interview with Holly Wood, regional Public Affairs manager, Fairmont Banff Springs Hotel, Alberta, Canada
5. *Guest's Perception of Water Conservation Options in Hotels: A Case Study.* McDermott, Mark, Conrad H. Hilton College of Hotel & Restaurant Administration, University of Houston. (Dr. Stephen Barth: 713-743-2430)
6. Ibid. 5

3.2 Management and Staff Activities

A. Health Fair at the Westin

Parts of the team, including SPU's environmental educator, participated in the Westin's health fair during 2000 and set up a booth with information covering the 1% Water Conservation Program, sustainable tourism and water resource and conservation education. The team developed a questionnaire designed to test water literacy that had to be answered verbally before prizes were distributed. In addition, a map showing the water conveyance system for the general area was displayed, facilitating a more focused "sense of place" with respect to our water sources. An *Ecoscape*, a relief structure designed to indicate how water flows through a watershed, was also used. The water conservation display enjoyed over 100 visitors making direct contact with booth staff and the Human Resources Department reported that we were well received.

B. Cedar River Watershed Tour

On a stunning October day in 2000, the team took a group of hotel managers and staff from both hotels to the Cedar River Watershed for a half day tour of one of Seattle's primary water sources. The Cedar River watershed is located northeast of Seattle's boundaries and is home to a wide range of wildlife, vegetation and fish.

The tour started at the Cedar River Watershed education center where the group was given a presentation regarding the geography and history of the watershed, its central role in providing drinking water, as well as a discussion and slides regarding wildlife, timber, salmon spawning and related issues. The group then traveled to Landsburg, the physical place where the Cedar River is split between drinking water diversion to Seattle and all its other uses for wildlife, the Ballard Locks and Lake Washington. The tour ended with a visit to Masonry Dam, Chester Morris Lake and Cedar Falls.

The purpose of the trip was to inspire a sense of place and respect for the water used at both home and in the hotel, as well as to provide a relaxed opportunity to ask questions.

C. Presentation at the Puget Sound Hotel and Motel Engineers Association Meeting

The team gathered at the meeting of the Puget Sound Hotel and Motel Engineers Association to describe the goals and implementation strategy for the hotel water conservation project. Given that most conservation projects are both initiated and directed by engineers, it was an appropriate venue in which to share the context of water conservation. The full text of the materials distributed at this meeting are found in the *Appendix 5*.

D. West Coast Grand Staff Meeting

In November 2000, the team held a staff only meeting in which representatives from most of the hotels' departments gathered. The purpose of the meeting was to introduce the

project, ascertain the general level of understanding regarding water and water conservation, and to provide an opportunity for staff to give their opinions and ask questions in an unrestricted setting.

Some of the questions were designed to help the team design a communications and education plan that would meet the needs of the associates. For instance, we asked if they were the utility, how they would design a water conservation program, using which languages, who the most trusted sources would be, and how to motivate associates to develop a conservation ethic. The results confirmed that fashioning "green teams" or "water smart teams" by department and tying successful competition with incentives would be a good way to solicit participation. The findings are reported in *Appendix 5.*

3.3 Educational and Outreach Materials

Throughout the project, materials were disseminated to both hotels regarding sustainable tourism, how engineering fits into sustainable tourism, geography of the Cedar River Watershed, and final documents designed for:

(i) staff and manager orientation (full text in *Appendix 5*)
(ii) sales and marketing staff, including national sales staff (see *Appendix 5*)
(iii) conference brochure for the West Coast for environmental conventioneers
(iv) poster reminding F&B to thaw in refrigerator;
(v) posters reminding associates and managers to report leaks; and
(vi) this final report, which will be distributed to corporate offices as well as these individual properties.

Hotel managers reviewed the materials before being finalized.

4.0 FACILITY FINDINGS AND RECOMMENDATIONS

4.1 The WESTIN

The Westin consists of two towers connected by a five story "Podium," that houses the restaurants and banquet facilities, check-in facilities, pool, and other common and administrative areas. The South Tower and Podium were constructed in 1961, while the North Tower was constructed in 1980. The South Tower contains 429 guest rooms and the North Tower 462 guest rooms, for a total of 891 guest rooms. The hotel is in an urban setting and there are no lawns or other significant irrigated areas.

Over the years, the Westin has implemented a number of water and energy conservation measures. With assistance from SPU, the hotel has replaced all toilets and urinals serving public areas with 1.6 gpf toilets and 1.0 gpf urinals. The hotel has also implemented partial recovery of steam condensate for use in the air scrubbers (rotoclones) serving several kitchen hoods. About 15 years ago the hotel installed a laundry rinse water recycling system, but this has been recently disconnected.

The Westin is served by two City water meters. One meter serves the South Tower, Nikko's restaurant, and Roy's restaurant. The other meter serves the North Tower, laundry, and most of the Podium including the Main (Banquet) Kitchen, Room Service Kitchen, The Golden Bagel, and the Cantina. There are deduct meters located at each of the two cooling towers (one on the North Tower and one on the South Tower). In addition, the Westin purchases steam from Seattle Steam as a source for most of its space and domestic hot water heating needs.

4.1.1 Overall Water Use

Over the twelve month period from January 1999 through January 2000, the hotel was billed an average of 111,307 gpd for the North Tower service and 66,373 gpd for the South Tower service, for a total of 177,680 gpd for the entire hotel, or 199 gpd per room. The hotel had a peak season billing of 188,890 gpd, or 212 gpd per room during the four months of June through September, reflected in bills dated July through October. Higher peak season use reflects higher summer occupancy rates and increased cooling load. In addition, the Westin uses a monthly average of 1,500 mlbs (thousands of pounds) of steam. Since Seattle Steam has no means of returning condensate to its facility, these purchases represent an additional consumption of approximately 6,000 gpd for steam production at Seattle Steam, which is not reflected in the Westin's bill from SPU.

Overall water use for the Westin is at the high end when compared to other hotels in the Seattle area. This may be partially explained by the existence of on-site laundry facilities as well as several large kitchens. The hotel also has a large number of single pass water-cooled ice machines on the guest floors and in the kitchens, and older high consumption toilets and showers in the guest rooms. In addition, it appears that leakage around toilet flappers in the older toilets may be a significant factor.

A chart showing percentages of the Westin's peak season water use attributable to various end uses is included in *Appendix 4.*

4.1.2 Heating and Cooling

Cooling Towers: Usage figures for the two cooling tower deduct meters is available from SPU billing data. The chilled water loops for the two towers are interconnected, so that during periods of light cooling load only one cooling tower need be operated, generally the north cooling tower. For 1999, water use for the cooling towers ranged from a low of 692 gpd during January (0.8 gpd/room) to a high of 19,809 gpd during July (22 gpd/room). As reported earlier, the two cooling towers consumed a combined annual average of only 5,960 gpd (7 gpd per room) and a peak season (June – September) combined average of 12,260 gpd (14 gpd per room). Approximately 75% of this water is consumed at the north cooling tower deduct meter, even during the peak season. Cooling tower use represents 3% of annual use and 6% of peak season use.

In order to keep dissolved solids from building up to unacceptable levels and causing scale or corrosion, controlled amounts of cooling tower sump water are regularly bled to sewer. Cycles of concentration may then be calculated to indicate what percentage of makeup water is evaporated vs. bled to sewer. The higher the cycles of concentration, the higher the percentage of water evaporated vs. bled. For example, for 5 cycles of concentration, approximately 1/5 (20%) of the water is bled while 4/5 (80%) is evaporated.

Discharge of bleed water is controlled automatically through a conductivity controller. A conductivity meter reading taken from a sample drained from the north cooling tower indicated 175 ppm dissolved solids vs. 30 ppm dissolved solids for domestic water. Taken together, these indicate 5.8 cycles of concentration, which is at the low end of acceptability. Increasing the cycles of concentration from 5.8 to 10.0 would result in savings of 8% of cooling water use, equivalent to approximately 1,000 gpd during the peak season.

Air Washers (Rotoclones): Four air washers are used in exhaust air from the kitchen hoods. Replacement of these air washers would require extensive ductwork. In order to reduce the use of potable water, the hotel uses steam condensate and ice machine reject water to provide water for these air washers for most of the year. At approximately 3 gpm each for 16 hours per day, it is estimated that the four rotoclones consume a total of 11,500 gpd, primarily from recycled sources. If the rotoclones were removed, the captured steam condensate and ice machine reject water could probably be routed to the laundry instead.

4.1.3 Guest Floors

Overview of Guest Floor Use

High-pressure water is pumped independently at each tower for use exclusively on the guest floors and by the cooling towers. Guest floor use includes use both within the rooms (showers, toilets, and lavatories,) as well as use by the single pass guest floor self serve ice machines (one per guest floor). Based upon spot checks on the fixtures in use as well as

daily usage data per fixture per room collected at the West Coast Grand (see the WCG room metering description), the following domestic water use per room, not including any leakage, is computed for a typical room at the Westin:

Fixture	**Daily Use Factor**	**Hot, gpd/rm**	**Cold, gpd/rm**	**Total, gpd/rm**
Toilets	7 uses @ 3.5 gpf	0.0	24.5	24.5
Lavatories & Sinks	1.0 min. @ 2.5 gpm	1.0	1.5	2.5
Showers	12 min. @ 3.5 gpm	28.0	14.0	42.0
Total		29.0	40.0	69.0

During July, high pressure water usage for the North Tower was logged, using an ultrasonic flowmeter, at 60,880 gallons for one day. During the time the flowmeter was installed, the north cooling tower deduct meter registered 4,620 gallons, and 8,400 gallons is estimated for guest floor ice machine use (40 ice machines at 210 gpd per machine). This leaves 47,860 gallons for 462 rooms, or 104 gpd/room for North Tower domestic plumbing. Maximum flow averaged over a one half-hour period was 119 gpm (0.26 gpm/room) and minimum was 12 gpm (0.026 gpm/room).

South Tower high-pressure water was then logged at 59,350 gallons per day over a 5-day period. Subtracting an estimated 7,640 gallons for cooling tower use (12,260 - 4,620) and 6,300 gallons for ice machines (30 ice machines at 210 gpd each), this leaves 45,590 gpd for 429 rooms, or 106 gpd/room for South Tower domestic plumbing. Maximum flow was 102 gpm (0.24 gpm/room) and minimum flow was 15 gpm (0.035 gpm/room). When a block of three floors (39 rooms) in the South Tower were logged at 10 second intervals, at no time did recorded usage fall below approximately 1 gpm (0.026 gpm/room), even around 3:00 AM, despite the fact that all individual events such as toilet flushes and lavatory uses were clearly distinct and accounted for separately. As a constant base flow, this would come to 37.5 gpd/rm, which corresponds closely with the figure of 35.6 gpd/rm unaccounted for as calculated in the table below. This observation reinforced the suspicion that this underlying use could be caused by leaks, most likely toilet flapper leaks. It was suggested that hotel staff systematically check for leaks using dye tablets in toilet tanks. When this was done, it was discovered that approximately 15% of the guest toilets in the South Tower were leaking. Engineering staff subsequently reported that these leaking toilets have now been repaired.

July Use (N & S Towers)	Hot & Cold gpd	Hot gpd/rm	Cold Gpd/rm	Total gpd/rm
Cooling Towers	12,260		13.8	13.8
Guest Ice	14,700		16.5	16.5
Dom. Water Estimate	61,479	29.0	40.0	69.0
Total Accounted For	88,439	29.0	70.3	99.3
Total Logged	120,230			134.9
Unaccounted For	31,790			35.6

Toilets

A spot check of toilets in two South Tower rooms indicated usage of approximately 3.5 gpf. Replacement of 3.5 gpf toilets with 1.6 gpf models, with 429 South Tower toilets at 7 flushes per day and 80% occupancy, would result in savings of 4,565 gpd.

Toilets in the North Tower are estimated at 3.5 gpf, dating from 1980. It appears likely that these 20-year-old toilets may also be leaking, though perhaps not to the same extent as those in the South Tower. It is recommended that that these toilets also be checked for leaks. Replacement of 3.5 gpf toilets with 1.6 gpf models for 462 North Tower toilets would result in additional savings of 4,910 gpd.

With estimated peak season use of 7 flushes/day/room, the combined North and South Tower toilets, not including any leakage, should account for approximately 21,800 gpd, or 11.5% of peak season use. Projected savings from replacement of all guest room toilets is 9,475 gpd, or 5% of peak season use, excluding any savings from leak reduction. Taking into account leak reduction, total savings from guest room toilet replacements could be appreciably higher.

Showers

Showers in both towers were calculated by hotel engineering staff at approximately 3.5 gpm. Cost effective savings in both water and energy should be achievable by changing to either 2.5 gpm or 1.75 gpm showerheads. Westin Engineering staff have tested 1.75 gpm showerheads on one floor with excellent results. It is estimated that showers are used an average of 13 minutes per room during peak season. Conversion to 2.5 gpm would save 11,500 gpd, or 6% of peak season use. Estimated energy savings of 3.8 million Btu would also occur.

Guest Room Lavatories

Guest room lavatories were calculated by hotel engineering staff at about 3.0 gpm, although approximately 5% have been changed to 2.0 gpm aerators. Cost effective savings are achievable by installing 1.5 gpm aerators. In addition to reductions in water use, 1.5 gpm aerators may make cleanup easier by reducing splashing, with no perceptible reduction in convenience to the guest. It is estimated that lavatories account for approximately 4 gpd/room, or 3,500 gpd, 2% of peak season use.

Guest Ice Machines

Single pass water cooled ice machines are located on each guest floor (70 in all). Repeated observations were used to establish approximately 7 hours per day of operation at 0.5 gpm, with an estimated daily consumption of 210 gpd per machine. These machines could be readily replaced with air-cooled models, as they are not in enclosed spaces. Guest ice machines represent approximately 14,700 gpd, or 8% of peak season use.

4.1.4 Food and Beverage

The Westin's F&B operation employs over 300 persons and is comprised of eight (8) distinct kitchens and food/bar operations. Over 1 million food covers are served each year. (A "cover" considered any transaction or sale, whether a cup of coffee or a multiple course meal.) Additionally, over 18,000 bar covers are served each year.

Approach:

In February 2000, a "shadow" walkthrough was conducted at the Westin Hotel's Food and Beverage (hereafter "F&B") operations to determine primary uses of water, and for each primary use to inventory equipment used and to highlight human influences affecting water consumption. In addition, hours of operation were electronically logged for the more significant water using equipment, along with instantaneous flow measurements taken with a stop watch and calibrated flow bag.

Primary uses of water for F&B include:

(1) Dishwashers
(2) Garbage disposals
(3) Single pass water cooled ice machines and guest watering
(4) Prep and Clean-up sinks, including rinsing and thawing under running water
(5) F&B cleaning, including water used to rinse down rolling carts and trays

Dishwashers

(a) Equipment & Process: There are nine dishwashers scattered throughout "F&B", including conveyor machines, single rack machines, and under counter machines. Some of the machines are all fairly old, having been installed when the hotel was built, circa 1960. At some point these machines will need to be replaced, ideally with more water efficient models.

Hours of operation were logged for the three larger conveyor type machines, along with instantaneous flow measurements. The Main Kitchen "Rack Champion" Model 23P dishwasher averaged 2.7 hours of operation per day over a seven week period. Instantaneous flow was 0.5 gpm. The Hobart Model CRS-103 dishwasher in Roy's averaged 16 hours per day over a two week period. Instantaneous flow varied considerably with a high of 5 gpm. The Hobart FT 326 dishwasher in the Fifth Avenue Kitchen was logged at 1.6 hours per day, although it appears that this data logger may have malfunctioned. Instantaneous flow for this machine was recorded at 0.5 gpm.

Based on these observations it is recommended that the Roy's dishwasher either be substantially rebuilt or replaced with a new water conserving model. Other dishwashers may be modified to use less water by: (a) installing or repairing an electronic eye that

activates the rinse arms use water only when dishes are present; (b) installing water conserving upgrades which slow the rack speed and reduce the rinse flow; (c) installing or repairing door curtains and; (d) ensuring pressure of the rinse water from the hot water booster is no higher than 20 psi or as recommended by the manufacturer.

(b) Human Influences and recommendations: People who work in the kitchen can facilitate water savings by only running full loads and pre soaking utensils and badly soiled kitchen ware. Either a small number of frequently used pieces of kitchen equipment, or inadvertent lapses in washing schedules may contribute to washing single or few kitchen pans, pots or utensils in a conveyor dishwasher. This would mean using excess water to wash only one piece of equipment. Additionally, maintenance staff should regularly check for excess water exiting the machine to the floor drain.

Garbage Disposals

(a) Equipment & Process: Six garbage disposals are used by F&B. They are rated at 8 gpm each. Based upon observations and interviews with staff it is estimated they each run approximately 30 minutes/day, consuming a total of 1,440 gpd.

(b) Human Influences: Other hotels report greater success in capturing food without using water by using mesh sink drains to capture food. Staff can be trained to empty food into a food grinder, whose contents are subsequently discarded as garbage, or engineering can remove the disposals and install simple mesh drains.

Ice Machines and Watering

(a) Equipment & Process: The Westin has 13 ice machines in F&B, most of which one are single pass, water-cooled machines.

Hours of operation were recorded, using a Pacific Science & Technology, model RTC-M motor logger, for a water-cooled Ice-O-Matic ice machine located in the Mezzanine Kitchen. Over a one month period, this machine ran an average of 10.8 hours per day. At 1 gpm, this single machine would consume approximately 650 gallons per day. It is recommended that all water-cooled ice machines either be replaced with air-cooled models or be connected to an existing closed loop cooling system.

(b) Human Influences and recommendations: It is a common practice for restaurants to serve ice water automatically when a guest is seated. This practice applies to room service as well as seated service. Moreover, water glasses are refilled when only one-third filled and may be refilled just before the customer leaves the restaurant. Many staff may equate quality service with keeping a water glass filled. A single party may be served 3 glasses of water per cover, containing 4 oz. water and 4 oz. ice per glass. Additional ice loading may be variable for subsequent glasses of water. If water-cooled ice machines are used, up to a half gallon of water may be required to make 4 oz. of ice. Based on 1 million covers/year, over 4,500 gallons of water per day could be used just to provide ice water to all guests. An easy solution to this quandary is to provide ice water only on request.

Prep and Clean Up Sinks

(a) Equipment: The Westin's F&B operation has 35 prep and clean-up sinks, a significant percentage of which do not have aerators. At 5 gpm or greater from an unregulated faucet, excessive water can be used for basic cleanup and food preparation. Installing aerators, in-line restrictors or foot pedals near dishwashing areas could help reduce the water used.

(b) Human Influences and recommendations:

(1) Thawing: Of particular concern is the practice of continuously running water over frozen food and to rinse rice, for up to 1.5 hours day. Using 2 sinks at 5 gpm each, one restaurant thawing in this manner would use 900 gallons per day for thawing alone.

Other options for thawing are in-refrigerator thawing (bottom shelf only, covered) or use of a stand-alone thawing unit. In-refrigerator thawing increases the operational efficiency of the refrigeration unit and a self-contained system may help ensure that frozen food is not inadvertently thawed above other product or uncovered. A stand-alone thawing unit uses only 20% of the time of in-refrigerator thawing.

(2) Applicable Law: During the team's outreach to other hotels, we noticed that several F&B staff believed that in-refrigerator thawing was not permitted under the local Food Code, thereby encouraging the use of continually running water. Local Seattle-King County law expressly permits in-refrigerator thawing: "*The food service establishment owner shall ensure that all potentially hazardous foods are thawed… A. In refrigeration units at a temperature of forty-five degrees Fahrenheit (45 F) or less….*"[1]

Consultation with the Director of the Food Protection Program revealed that the only limitations applicable to in-refrigerator thawing pertained to: (i) having the food thaw on the lowest rack possible to prevent dripping on other product; and (ii) ensuring the food was covered.[2]

(3) Rice washing: At Nikko's, rice washing was observed under a flow measured at 10 gpm. We were told that this occurred daily for approximately 2.5 hours per day, which would consume around 1,500 gallons of water per day. Further research indicated that rice washing should be accomplished using an agitation method by which water is sprayed over the rice in a colander, a process that might only take 4 minutes compared to 1.5 hours. It is unclear on what basis rice was being washed in this manner, and may reinforce the need for staff training and orientation to food preparation. Nikko's is a tenant of the Westin and is not directly under Westin staff control, as well as getting no direct billing for their water use.

Notes

1. King County Food Code Title 5: chapter 5.16.020

2. Phone conversation with *Food Protection Program* office, March 2001: (206) 296-4781, 2124 4th Avenue, 4th floor, Seattle 98121

F&B Cleaning

(a) Equipment & Process: Standard mop buckets are used to clean F&B kitchens, as well as pressure hoses for perimeter uses. Water is used to clean loading dock areas, rolling carts, hot carts and other surfaces associated with F&B. For instance, it is estimated that 20,800 gallons water is used each year to pressure wash the loading dock where food deliveries take place. An unspecified percentage of this water is used to clean sticky surfaces occasioned by the hotel's glass recycling program. It is estimated that 40,500 gallons/year is used to wet mop all the F&B kitchen floors and 104,000 gallons/year is used to clean hot and rolling carts. These carts are used to transport food from the kitchen to staging areas and to transport within F&B floors and elevators.

(b) Human Influences and recommendations: Train staff to ensure as little water is used as possible to wash the floors and rolling carts. An entire bucket of hot water may not be necessary to clean nominally clean carts.

Consider using steam table water for initial floor washing and if breakdown of the steam table coincides with cleaning schedules, its higher temperature can facilitate cleaning. Check with the health department to ensure that this subsequent use is in accordance with their policies. This water should be relatively free of sediment and can be poured into mop buckets directly.

If possible, sweep loading docks and only spot wash problem areas rather than power washing the entire surface area. This would ideally become part of an overall water conservation program.

4.1.5 Laundry Operations

The Westin's laundry operation is in-house and consists of 29 staff. Its operations can extend from 12 hours daily to almost 16 hours depending on the occupancy rate, conference and banquet functions and other variables in the hotel.

(a) Equipment & Process: The laundry houses: (i) two (2) 700-lb washers; (ii) one (1) 65-lb washer and (iii) two (2) Maytag top loading washing machines. The 700-lb machines use between 684 and 1,431 gallons per load depending on the type of material being washed and the degree of soil. One load generally equals 640 lbs of material. The 65-lb washers use between 147 and 210 gallons of water per load to wash 50 lbs of material.

The Westin accommodates, on average, 8,000 lbs/day during the slow season (October-April) and 15,000 lbs/day during high season (May-September), meaning that the hotel washes approximately 4.9 million lbs of laundry per year. With an average metered use for

the laundry of 27,000 gpd, approximately 9.8 million gallons of water are used per year, or 2.0 gallons per pound of material washed.

The use of ozone gas, O^3, is an excellent way in which to reduce water use in laundry operations. Ozone systems use air to create ozone gas electrically. The gas then becomes the primary oxidant, or cleaner, for laundry, thereby replacing much of the detergent and bleach, as well as allowing a typical laundry cycle to be completed mostly in cold water. Additionally, fewer rinse cycles are needed to rinse out the remaining chemicals leading to the water savings. During laundering, ozone laundry systems also purify and disinfect wash water; decompose fats, oils and grease (FOG) and soften the wash water with a neutral pH level. [1]

The Westin hotel currently plans to install such an ozone system. Other hotels such as the Greenbelt Marriott, saved over $50,000/year in utility and processing costs after installing an ozone system. [2]

(b) Human Influences and recommendations: The hotel discovered that its laundry floors were not sealed, causing inadvertently dropped laundry to be rewashed a second time due to smudging. The hotel plans to seal its floors to reduce second washings.

4.1.6 Westin Housekeeping

The Westin's housekeeping department employs 118 staff and is responsible for cleaning 332,000 rooms annually. In addition, the hotel contracts with an outside company to clean common areas during the late evening, extending from 11 pm through 7 am.

Guest Room cleaning

The team shadowed housekeeping staff for one morning to better understand the relationship between cleaning and water use. We shadowed a senior housekeeper to observe the techniques used to clean and discovered nominal water use. There are up to 42 discrete cleaning steps taken for each room, in which one guest room must be cleaned within a half hour.

*a) Equipment & Process: Water use during room cleaning**

(a) Sink: Sinks faucets ran for 5 seconds during cleaning and at 3.0 gpm, 0.25 gallons of water is used per room. Estimated water use for sink cleaning is 223 gallons/day for all 891 rooms.
(b) Tub/Shower: Shower water ran for 8 seconds during cleaning and at 3.5 gpm, 0.47gallons of water is used per room for this function. Estimated water use for tub/shower cleaning is 419 gallons/day.
(c) Toilet cleaning: Toilets are flushed twice during cleaning; once prior to application of chemicals and scrubbing, and once following this application. The North tower has 3.5 gpf toilets (462) and the South tower has 5 gpf toilets (429). Using an average of

4.25 gallons per flush (gpf), estimated water use is 3,787 gallons/day. Installation of low flow 1.6 gpf toilets would substantially reduce this water use.

Notes

1. *American Laundry News*, Vol. 24, No 11, November 1998
2. EDC Ozone Laundry Systems package: (972) 257-0322

** Total water use for guest toilet room cleaning per year (excluding the use of ice and laundry):* 4,429 gallons/day, for all 891 rooms.

(b) Human influence and recommendations: The initial toilet flush is not necessary if the bowl is clean upon room entry, and by avoiding this step will reduce water use by 1,893 gallons/day. Toilet bowl chemicals should be applied as soon as the housekeeper enters the room, and without an initial toilet flush. Application of the cleaning chemical earlier in the room cleaning process will enable use of a less caustic toilet bowl cleaner (more time to allow the chemical to activate while other cleaning takes place).

Triple sheeting in which three sheets are used per bed, contributes to laundry loads.

The Westin has adopted a towel-linen program in which multiple-night guests are given the choice not to have their linens and towels laundered daily. After tracking average pounds of laundry per occupied room before and after the towel-linen adoption, the results have clearly demonstrated a reduction of over a pound per room average.

Common Area Cleaning

Approach: The team shadowed the graveyard shift to observe partial night cleaning and to ask questions about the process. The hotel contracts with an outside company to provide shift cleaning services that cover:

a. Restrooms
b. Lobby
c. Lobby marble
d. Lobby court bar
e. Entrance and exits
f. Associate restrooms
g. Escalators
h. Public elevators
i. Service elevators
j. Cantina and foyer

Water use applications:

1. Sink cleaning
2. Rotowashing public restrooms
3. Rotowashing pool and spa areas
4. Carpet extraction and buffing

5. Surface cleaning
6. Entry mat cleaning
7. Pressure washing 5th Avenue

(a) Equipment & Process: The contractor is required to bring their own equipment although some may be shared with the hotel. Water using equipment includes rotowashers, mop and bucket systems, carpet buffers, and carpet extractors. Public area shower and toilet cleaning, carpet cleaning and spa draining consume the largest volume of water.

(b) Human influences: The cleaning contract should be amended to require the contractors to be trained in water conservation and energy efficiency, and to actively practice both during the course of their work. Keeping entry areas as clean as possible will reduce the frequency of carpet buffing and extraction, as well as training for F&B staff that are serving in carpeted banquet areas. Unless an area is sticky, the hotel might choose to replace pressure washing with broom sweeping and spot cleaning.

4.1.7 Westin Pool and Spa

The Westin has a 25,000 gallon pool that is drained annually, and two 1,200 gallons spas which are drained twice a week. The team was particularly interested in gauging the basis for such frequent spa drainage as this practice averages 685 gallons/day. The circulation system components of swimming pools, spas and hot tubs are set forth in the National Sanitation Foundation's (NSF's) standard 50-2000, which was designated as an American National Standards Institute (ANSI) standard in January 2000. [1]

The City of Seattle's Department of Health regulates both microbial testing and drainage frequency. The Washington Administrative Code, Chapter 246-260, governs the water balance chemistry of chlorine and pH. This balance determines the frequency of drainage so provided the water chemistry is balanced, spa drainage should be capable of being decreased by half.

Notes

1. ANSI: http://www.ansi.org or (212) 642-4900. The National Sanitation Foundation or NSF standards are ANSI accredited.

4.1.8 Summary of Potential "Equipment Measures"

Seven potentially cost-effective "Equipment Measures" are proposed. Estimated savings potentials and costs are preliminary. It is the responsibility of the hotel to confirm any estimates for their own budgetary purposes. Potential savings from all of these measures combined is estimated at 54,000 gpd, or around 30% of annual average water usage for the hotel. Savings potential could be significantly higher, up to 40%, if reduction in toilet leakage is taken into account.

1. Replace Guest Room Toilets with 1.6 gpf Models

Potential Savings: Savings are estimated at 9,475 average gpd (not including leakage reduction). This would translate into annual dollar savings of approximately $28,000. Savings may be substantially higher after reduced leakage is taken into account.

Potential Cost: Cost will vary with type of toilet selected. For illustration a purchase cost of $90 per toilet is used, plus $30 for in-house installation, minus a $60 per toilet incentive from SPU, for a net installed cost of $60 per toilet, or $53,460 for 891 toilets.

Payback Period: Approximately 1.9 years (not including savings related to leak reduction). Actual payback after accounting for savings attributable to leak reduction could be under one year.

2. Replace Guest Room Showers with 2.5 gpm Showerheads

Potential Savings: Savings are estimated at 8,500 average gpd. Water savings for water and sewer would amount to approximately $28,000 annually. Significant energy savings would also be available. Energy savings resulting from less purchased steam to make hot water will be in the neighborhood of 1,000 mbtu.

Potential Cost: At an estimated $40 installed cost per showerhead, total cost would amount to $35,500. Depending on choice of showerhead, actual cost may be lower.

Payback Period: One year or less when energy savings are included.

3. Replace Guest Room Sink and Lavatory Flow Restrictors with 1.5 gpm Aerators

Potential Savings: Savings are estimated at 2.0 gpd per occupied room, 1,425 average gpd, or $4,800 per year.

Potential Cost: Aerators may be purchased for around $1 each. Total installed cost may be estimated at $2 each, for a cost of $3,564 for 1,782 aerators (2 per guest room). Additional energy savings should apply.

Payback Period: Less than one year.

4. Replace Guest Floor Ice Machines with Air Cooled Models

Potential Savings: 70 machines at 210 gpd per machine equal 14,700 gpd, or $49,000 per year.

Potential Cost: Cost for a replacement 300 lb capacity air-cooled machine, complete with dispenser is estimated at $4,000, minus a $300 per machine incentive available from SPU. Net cost for 70 machines would be $259,000. As existing machines may be nearing the end of their useful life, it may be appropriate to begin a preventive replacement program, scheduled over a number of years. Installation of narrower machines may also allow side by side installation of vending machines, such as for drinks, providing for an increase in revenue. As an alternative, ice machines could be removed from every other floor and replaced with drink machines.

Payback Period: 5.75 years (less if vending machine could be added)

5. Install Ozone Laundry System and/or Rinse Water Recycle

Potential Savings: A 25% reduction in laundry water use would result in saving 6,750 gpd or $19,000 per year for water and sewer. A 20 degree F reduction in average water temperature (27,000 gpd) would result in savings of $18,000 per year for purchase of steam, based on $11 per thousand pounds of steam. Additional savings may be available from reductions in chemical and labor costs.

Potential Cost: Estimated at $79,000.

Payback Period: Approximately 2 years, not counting potential chemical or labor savings.

6. Connect Kitchen Ice Machines to Glycol Loop or Replace with Air Cooled Models

Potential Savings: 5,200 gpd, or $15,000 per year.

Potential Cost: Replacement of 10 machines at an estimated cost of $3500 per machine, minus an incentive of $600 per machine comes to a net total cost of $29,000.

Payback Period: Under 2 years.

Action Taken: Since the initial field work and development of draft recommendations, the Westin has replaced two 600 pound kitchen ice machines with air-cooled models.

7. Replace Dishwasher in Roy's Kitchen with Water Conserving Model

Potential Savings: Projecting average savings of 2 gpm, 16 hours per day, this would result in water savings of 1,920 gpd, with water and sewer savings of around $5,500 per year. Energy savings are estimated at $4,000 per year. Additional chemical savings may also be available.

Potential Cost: Estimated at $15,000.

Payback Period: Under 2 years.

4.1.9 Summary of Potential "Behavior Measures"

Six "Behavior Measures" are proposed. It is difficult to predict exact savings for behavioral measures. However, potential savings from all of these measures combined are estimated at 10,000 gpd, or between 6% of average water usage for the hotel. Savings potential could be significantly higher. Up-front costs are minimal, so the payback for each of these measures should be very attractive.

1. Reduce or Discontinue "Triple Sheeting"

Potential Savings: Approximately 2 gallons of water per sheet, or 1,780 gallons per day for all 891 rooms. Additional savings would be available for labor (both laundry and housekeeping), energy (both for heating water and drying), and laundry chemicals.

Potential Cost: No cost/cost reduction.

Payback Period: Immediate.

2. Increase Cooling Tower Cycles of Concentration to 10

Potential Savings: Water savings are estimated at 500 average gpd (1,000 gpd during peak season). Utility savings would amount to approximately $500 annually. Reduced chemical use may result in additional savings.

Potential Cost: Minimal.

Payback Period: Immediate.

3. Educate Kitchen Staff Regarding Water Conservation

Educate of F&B staff regarding correct techniques for thawing of frozen food, rice rinsing, dishwasher loading and equipment cleaning.

Potential Savings: Water savings estimated at 2,500 average gpd. Utility savings would amount to approximately $7,000 annually. Additional energy savings may be available.

Potential Cost: Minimal.

Payback Period: Immediate.

4. Reduce Toilet Flushes During Room Cleaning

Potential Savings: Water savings attributable to flushing one time less per cleaning are estimated at 3,000 average gpd. Utility savings would amount to approximately $8,500 annually.

Potential Cost: None

Payback Period: Immediate

5. Provide Ice Water Only On Request

Potential Savings: Water savings are estimated at 500 average gpd. Utility savings would amount to approximately $1,500 annually.

Potential Cost: None

Payback Period: Immediate.

6. Reduce Frequency of Spa Drainage

Potential Savings: Water savings from reducing spa drainage to once weekly from twice weekly are estimated at 200 average gpd. Water and Sewer savings would amount to approximately $500 annually. Additional energy savings would be expected.

Potential Cost: Minimal.

Payback Period: Immediate.

4.2 West Coast Grand Hotel

The West Coast Grand consists of a 20-floor tower with 297 guest rooms. All guest rooms are located above the fifth floor. There is an independently operated restaurant in the basement, with it's own water meter, though it appears that hot water to this restaurant is supplied by the hotel. There is also a restaurant and banquet facility operated by the hotel, located on the second and third floors. The fourth and fifth floors are leased as office space to a bank. The hotel is in an urban setting and there are some outside planters, but no lawns.

The building was originally constructed as a bank, but was renovated as a hotel in 1996. As part of the renovation, all guest room and public plumbing fixtures were upgraded to current water efficiency standards.

The West Coast Grand is served by a single City water meter. A separate meter serves The Elephant & Castle, the independent restaurant located in the basement. Deduct meters are in place for irrigation and for the cooling tower. A booster pump provides high pressure hot and cold water to all the guest floors and the cooling tower. A low (City) pressure system provides hot and cold water to the first five floors and basement, including the kitchens, restaurants, public areas, and office areas.

4.2.1 Overall Water Use

Over the twelve month billing period from January through December 2000, the hotel consumed an annual average of 27,600 gpd, or 93 gpd per room. Usage for August 2000 (reflected in the September billing) averaged approximately 37,000 gpd, or 125 gpd per room. Higher peak season use reflects higher summer occupancy rates and increased cooling load.

Irrigation usage as recorded on the irrigation deduct meter averaged only 43 gpd over the two year period, or 0.15 gpd per room.

Overall water use for the West Coast Grand, as measured by gpd per room, is moderate when compared to other hotels in the Seattle area. This may be partially explained by the lack of on-site laundry facilities or large on-site kitchens. Additionally, given the recent renovation, nearly all plumbing fixtures, excluding kitchen sinks, meet current efficiency standards.

4.2.2 Cooling Tower

Cooling tower usage as recorded by a deduct meter is available from SPU billing data. The cooling tower is operated approximately 7 months out of the year. During each of the last three years (1998-2000), peak cooling tower use has occurred during the month of June (July billing). During June of these years, cooling tower use averaged between 8,200 gpd and 11,350 gpd, and accounted for between 24% and 33% of total hotel water use. During

the year 2000, cooling tower use represented 8% of annual use and 16.5% of peak season use (June – September).

Cooling tower usage appears to be much higher than would be expected for a facility such as this. A sample of sump water was taken and cycles of concentration were calculated at 3.3, which is substantially below optimum levels. Hotel engineering staff has indicated that the existing conductivity controller is non-functional and the hotel is interested in installing a replacement, which could be provided by the chemical treatment provider who services the tower. With a properly functioning controller set at optimum cycles of concentration it is projected that cooling tower water use could be reduced by up to 50%.

4.2.3. Steam Heat Exchangers

The West Coast Grand purchases steam from Seattle Steam as an energy source for both space heating and heating of domestic hot water. Recurring problems with malfunctioning steam heat exchangers have been observed and reported by engineering staff. These problems have involved heat exchangers used for space heating as well as heat exchangers used for domestic hot water, and have resulted in periodic dumping to sewer, sometimes on a daily basis, of thousands of gallons of hot water. The exact amount of hot water which has been dumped is not known, but it is estimated that the cost to the hotel is substantial, as costs for water, sewer, and energy are all involved.

Upon our recommendation, the hotel engineering staff has been provided with a submeter from SPU to be installed on the cold water feed line to the heat exchanger for the space heating loop. When this meter is installed it will allow closer monitoring of this heat exchanger. We also recommend that meters be placed on the feed lines leading to both the high pressure and low pressure domestic hot water heat exchangers.

4.2.4 Guest Floors

Guest floor use includes use both within the rooms (showers, toilets, and lavatories) as well as use by water-cooled ice machines that are located on every other guest floor. The booster pump provides high-pressure water to the guest floors as well as to the cooling tower.

Hot and cold water lines leading to a block of four rooms (all occupied) were data logged, with separate logs taken for hot and cold water (on consecutive days) at 10-second intervals for periods in excess of 24 hours. These logs indicated that each room used an average of 22.7 gpd of cold water and 21.0 gpd of hot water, for a total of 43.7 gpd per occupied room.

Close inspection of the data indicated a daily average of 7 toilet flushes per room @ 1.6 gpf, with associated lavatory use of approximately 2.5 gallons per day. Showers were used for an average of 12 minutes per room @2.5 gpm (2/3 hot water, 1/3 cold water) for an average daily use of 30 gpd per room (20 gpd hot, 10 gpd cold).

Fixture	Daily Use Factor	Hot, gpd/rm	Cold, gpd/rm	Total, gpd/rm

Toilets	7 uses @ 1.6 gpf	0.0	11.2	11.2
Lavatories & Sinks	1.0 min. @ 2.5 gpm	1.0	1.5	2.5
Showers	12 min. @ 2.5 gpm	20.0	10.0	30.0
Total		21.0	22.7	43.7

At the beginning of August, usage for combined high pressure hot and cold water was logged at 15 minute intervals, using the ultrasonic flowmeter, at 28,411 gallons for one day (95 gpd/rm). Immediately afterwards, high pressure hot water was logged over a two day period, averaging 5,889 gpd, or 19.8 gpd/rm. During the time the flowmeter was installed, the cooling tower deduct meter registered 450 cubic feet (3,366 gallons) and 1,200 gallons (4 gpd/rm) is estimated for guest floor ice machine use (7 ice machines at 160 gpd per machine).

Assuming 41.5 gpd per room (at 95% occupancy) for domestic plumbing, 16,816 gallons may be accounted for, leaving 11,595 gallons of cold water (39.1 gallons per room) unaccounted for. This unaccounted for use occurred primarily between the hours of 8:30 PM and 11:30 PM.

Aug. Use (High Press.)	Hot & Cold gpd	Hot gpd	Cold gpd	Total gpd/rm
Cooling Tower	3,366	0	3,366	11.3
Guest Ice	1,120	0	1,120	3.8
Dom. Hot Water	5,925	5,925	0	21.0
Dom. Cold Water	6,404	0	6,404	22.7
Accounted For	16,815	5,925	10,890	58.8
Total Logged	28,411	5,889	22,522	95.7
Unaccounted For	11,596	(36)	11,632	39.0

We suggest that further research be done to determine if a specific piece of equipment can be identified contributing to the unaccounted for use. A primary suspect would be the steam heat exchanger used for space heating, as the cold water feed for this heat exchanger comes off this high pressure service.

Toilets

Guest room toilets have been logged at approximately 1.6 gpf. It is understood all toilets are ultra low flush (1.6 gpf) models. Given the low recorded flow around 4:00 AM, it appears that toilet leakage is not a substantial problem. No recommendations are made regarding toilets.

Showers

Showers have been logged at approximately 2.5 gpm, averaging 12 minutes use per room, 2/3 hot water and 1/3 cold water. No recommendations are made regarding showers.

Guest Room Lavatories

From log data, guest room sinks and lavatories are estimated to run approximately 1.0 minutes per day at 2.5 gpm. Cost effective savings may be achievable by installing 1.5 gpm aerators. In addition to reductions in water use, 1.5 gpm aerators may make cleanup easier by reducing splashing, with no perceptible reduction in convenience to the guest. It is estimated that sinks and lavatories account for approximately 2.5 gpd/room, or 740 gpd, 2% of peak season use.

Guest Ice Machines

Single pass water-cooled ice machines are located on every other guest floor (6 in all). During the study period, a residential style 3/4" in line meter was used to measure wastewater from one guest floor ice machine. In addition, a Pacific Science and Technology RTC-M Motor Logger was installed and read following a 13 day period to record hours of operation for the ice machine. The motor loggers were of a type capable of recording total time of operation of an operating electric motor in the vicinity of the logger.

The motor logger recorded operation of the one machine at 7.0 hours per day. Over a 14 day period, the ¾" meter recorded an average of 147 gpd of wastewater from the machine, or approximately 0.35 gpm during operation. Assuming an additional 100 lbs per day of ice production, total water usage would be 160 gpd per machine. The 7 guest ice machines represent 1,120 gpd, or 4% of average annual use. These machines could be replaced with air cooled models, if an exhaust grill were placed in the closets they are in. An existing exhaust duct runs directly over each closet.

4.2.5 Food and Beverage (F&B)

In February 2000, a shadow walkthrough was conducted at the West Coast Grand Hotel's food and beverage (hereafter "F&B") operations. The West Coast Grand's F&B operation employs over 58 staff and includes the restaurant, kitchen and banquet services. Over 146,000 food covers are served each year, a "cover" considered any transaction or sale, whether a cup of coffee or a multiple course meal. Assuming an industry average of around 20 gallons per cover, it is estimated that F&B use is approximately 8,000 gpd.

Primary Areas of Water Use

Primary uses of water are:

(1) Dishwashers and Pre-Rinse
(2) Miscellaneous equipment such as coffee and tea machines, dipwell ice-cream machines and steam tables

(3) Food preparation, including thawing under running water and water used to make soups, stocks, pasta, rice and other menu items
(4) Cleaning, including water used to rinse down rolling carts and trays.

Dishwashers and Pre-Rinse (Hotel only)

(a) Equipment & Process: There is one dishwasher in F&B that is a conveyor C-line type. Upon visual inspection this machine appeared to be operating properly, without excess water draining to the floor sink. However, the pressure gauge for rinse water pressure was missing so that proper setting for the rinse water pressure reduction valve could not be confirmed. It is recommended that a new pressure gauge along with a water hammer arrestor be installed on the rinse line, and rinse pressure checked and set appropriately.

Flow through the manual pre-rinse sprayer was measured at 4 gpm. It is recommended that the spray head be replaced with a new 2.5 gpm unit, very common now in commercial kitchens.

(b) Human Influences: Staff in the kitchen can facilitate water savings by only running full loads and pre-soaking utensils and badly soiled kitchen ware. Either a small number of frequently used pieces of kitchen equipment, or inadvertent lapses in washing schedules may contribute to washing single or few kitchen pots, pans or utensils in a conveyor dishwasher.

Ice Machines and Guest Watering

(a) Equipment: The West Coast Grand has two ice machines in F&B, both of which are air-cooled machines.

(b) Human Influences: It is a common practice for restaurants to serve ice water automatically when a guest is seated. This practice historically applies to room service as well as seated service. Moreover, water glasses are refilled when only one-third filled and may be refilled just before the customer leaves the restaurant. Many staff may equate quality service with keeping a water glass filled. A customer may be served up to 3 glasses of water per cover and contains 4 oz. water and 4 oz ice per glass. Based on 1 million covers/year, over 500 gallons of water per day could be used just for ice water.

This year, the West Coast Grand adopted a new policy whereby for banquet service, they have replace their 12 oz glasses with 8 oz pilsners, placing a pitcher of water on each table. The F&B manager reports that serving water in this manner has reduced water consumption significantly.

The team recommends to both hotels that water only is served upon request for room service and in-restaurant dining, and that coffee and tea press service for one guest be tailored to the amount needed. These presses are typically filled for one-person service, and by the time the guest is ready for a subsequent cup, the liquid has cooled already and must be discarded.

Prep and Clean Up Sinks

(a) Equipment & Process: The West Coast Grand's F&B operation has 11 prep and clean-up sinks, a majority of which did not have aerators and are completely open. At a 5 gpm flow rate, excessive water can be used for basic cleanup and food preparation.

Installing in-line flow restrictors and/or foot pedals in the dishwashing areas would help reduce the water used.

Leaks are a common problem for prep and cleanup sinks. Inexpensive ceramic valve retrofits, providing a long term cure for leaks, may be available for many of these faucets.

(b) Human Influences and recommendations

(1) Thawing: Although not specifically observed at the West Coast Grand, thawing frozen food using continuously running water can use significant amounts of water. If water runs continuously over frozen food, assuming a minimum of one hour/week, or 52 hours a year, up to 15,600 gallons of water year is used.

Staff should be educated to use other options for thawing such as in-refrigerator thawing (bottom shelf only, covered) or use of a stand-alone thawing unit. In-refrigerator thawing increases the operational efficiency of the refrigeration unit and a self-contained system may help ensure that frozen food is not inadvertently thawed above other product or uncovered. A stand-alone thawing unit uses only 20% of the time of in-refrigerator thawing.

(2) Applicable Law: During the team's outreach to other hotels, it was noted that several F&B staff believed that in-refrigerator thawing was not permitted under the local Food Code, thereby encouraging the use of continually running water. Local Seattle-King County law expressly permits in-refrigerator thawing: "*The food service establishment owner shall ensure that all potentially hazardous foods are thawed… A. In refrigeration units at a temperature of forty-five degrees Fahrenheit (45 F) or less….*" Discussions with the Director of the Food Protection Program ensured SPU that the only limitations applicable to in-refrigerator thawing pertained to: (i) having the food thaw on the lowest rack possible to prevent dripping on other product; and (ii) ensuring the food was covered.

Miscellaneous

(a) Equipment: F&B also houses a steam table, 4 coffee and tea machines, and the contract restaurant has an ice-cream chiller. The dipper well for the ice cream scoop uses a continuous flow of water to maintain sanitary conditions.

(b) Human influences and recommendations: Ensure that coffee and tea are not over served and that staff is trained to turn off ice-cream chillers and continuous rinse functions when not in use. Dipper well flows can also be reduced by 50%.

F&B Cleaning

(a) Equipment & Process: Standard mop buckets are used to clean F&B kitchens, as well as pressure hoses for perimeter uses.

Water is used to clean loading dock areas, rolling carts, hot carts and other surfaces associated with F&B. These carts are used to transport food from the kitchen to staging areas and to transport within F&B floors and elevators.

(b) Human Influence: Train staff to ensure as little water is used as possible to wash the floors and rolling carts. A full bucket of hot water may not be necessary to clean nominally clean carts.

Consider using steam table water for initial floor washing and if breakdown of the steam table coincides with cleaning schedules, its higher temperature can facilitate cleaning. Check with the health department to ensure that this subsequent use is in accordance with their policies. This water should be relatively free of sediment and can be poured into mop buckets directly.

If possible, sweep loading docks and only spot wash problem areas rather than power washing the entire surface area. This would ideally become part of an overall water conservation program.

4.2.5 Housekeeping

Guest Room cleaning

Approach

The West Coast Grand has a housekeeping staff of 50 and cleaned 83,037 rooms in 2000. The team shadowed housekeeping staff for one morning to better understand the relationship between cleaning and water use. A senior housekeeper was shadowed to observe the techniques used to clean and discovered water used for room cleaning was nominal. There are up to 20 discrete cleaning steps taken for each room, in which one guest room must be cleaned within a half hour.

*(a) Equipment & Process: Water use during room cleaning**

(d) Sink: Sinks faucets ran for 5 seconds during cleaning and at 2.5 gpm, 0.2 gallons of water is used per room. Estimated water use for sink cleaning is 45 gallons/day.
(e) Tub/Shower: Water from the tub spout ran for 32 seconds during cleaning and at an average rate of 6 gpm, 3.2 gallons of water is used per room for this function. Estimated water use for tub/shower cleaning is 728 gallons/day.
(f) Toilet cleaning: Toilets are flushed twice during cleaning; once prior to application of chemicals and scrubbing, and following this application. Toilets are rated at 1.6

gpf, so 3.2 gallons of water are used for toilet cleaning per room. Accordingly, an estimated water use is 728 gallons/day.

** Total water use for room cleaning per day (excluding the use of ice and laundry):* 1,500 gallons/day (for all 297 rooms).

(b) Human influence and recommendations: Very little water is used during room cleaning but chemicals should be applied to the toilet bowl as soon as the housekeeper enters the room, and without an initial toilet flush. Application of the cleaning chemical earlier in the room cleaning process will enable use of a less caustic toilet bowl cleaner (more time to allow the chemical to activate while other cleaning takes place).

The initial toilet flush is not necessary if the bowl is clean upon room entry, and by avoiding this step will reduce water use by 364 gallons/day.

Towel-Linen Program: The West Coast Grand has adopted a towel-linen program that has a 2% participation rate per month. They expect to increase participation as the program matures and housekeeping staff support increases.

4.2.6 Summary of Proposed "Equipment Measures"

Three potentially cost effective "equipment measures" are proposed. Potential savings from these measures combined is estimated at 1,340 gpd, or approximately 5% of annual water usage for the hotel.

1. Replace Guest Floor Ice Machines with Air Cooled Models

Potential Savings: Seven (7) machines at 147 gpd per machine equals 1,000 gpd, or approximately $3,000 per year.

Potential Cost: Estimated cost to retrofit from water-cooled to air-cooled is $3,500 per machine minus an estimated $300 incentive from SPU, for a net total of $22,400 for all 7 machines.

Payback Period: 7.5 years.

2. Replace Kitchen 4 gpm Pre-Rinse Spray Head with 2.5 gpm Spray Head

Potential Savings: Assuming 60 minutes per day of spray head use, 90 gallons per day of water would be saved, for annual water and sewer savings of $260. With energy reductions, annual savings of over $400 may be expected.

Potential Cost: Estimated installed cost is $40.

Payback Period: Approximately one month.

3. Replace Guest Room Sink and Lavatory Flow Restrictors with 1.5 gpm Aerators

Potential Savings: Potential savings are estimated at 1.0 gpd per occupied room, or 250 average gpd. Taking into account energy reductions, annual savings of around $1,200 may be expected.

Potential Cost: Aerators cost approximately $1 each. Total installed cost may be estimated at $2 each, for a cost of $1,118 for 594 aerators (2 per guest room).

Payback Period: One year.

4.2.7 Summary of Proposed "Behavioral/Maintenance Measures"

Six behavioral and maintenance measures are proposed. Potential savings potential from this measures combined is estimated at over 8000 gpd, or approximately 30% of annual water usage for the hotel.

1. Monitor and Improve Performance of Steam Heat Exchangers

- Install sub-meters on cold water feed lines to all heat exchangers.
- Monitor and log sub-meter readings regularly.
- Perform repairs as necessary to avoid excess use.

Potential Savings: Estimated up to an average of 5,000 gpd. With energy savings included, savings could be in the tens of thousands of dollars per year.

Potential Cost: To be determined

Payback Period: Likely less than one year

2. Monitor and Improve Performance of Cooling Tower

- Install a new conductivity controller.
- Instruct water treatment service provider to increase cycles of concentration to 10.0.
- Log cooling tower water usage and conductivity readings at least monthly.

Potential Savings: A reduction in water use of 25% - 50%, resulting in a peak season reduction in cooling water of 1150 – 2300 gpd, for an annual savings of $1250 - $2500 per year.

Potential Cost: Estimated cost including installation is around $1000. An incentive of up to 50% may be available from SPU.

Payback Period: Less than one year.

3. Monitor and Improve Performance of Dishwasher

- Install a pressure gauge and water hammer arrester on dishwasher rinse water line and adjust pressure per manufacturer's recommendations.
- Install a sub-meter on the dishwasher hot water line and monitor usage. Perform maintenance as necessary to avoid excessive use.

Potential Savings: To be determined

Potential Cost: $500

Payback Period: Likely less than one year

4. Educate Kitchen Staff Regarding Water Conservation

- Educate F&B staff regarding correct techniques for thawing of frozen food, rice rinsing, dishwasher loading and equipment cleaning.
- Install flow restrictors at sinks commonly used for thawing of frozen foods.

Potential Savings: Water savings are estimated at 1,000 average gpd. Utility savings would amount to approximately $3,000 annually. Additional energy savings may be available.

Potential Cost: Minimal

Payback Period: Immediate

5. Reduce Toilet Flushes During Room Cleaning

Potential Savings: Water savings attributable to flushing one time less per cleaning are estimated at 350 average gpd. Utility savings would amount to approximately $1,000 annually.

Potential Cost: None

Payback Period: Immediate

6. Provide Ice Water Only On Request

Potential Savings: Water savings are estimated at 250 average gpd. Utility savings would amount to approximately $700 annually.

Potential Cost: None

Payback Period: Immediate

5.0 Tools for Behavioral Change

5.1 Developing A Water Management Plan

Historically, short-term engineering retrofits and other projects initiated based on peaks in natural resource costs have lead conservation and efficiency efforts. It is preferable to have businesses, including hotels, develop a long-term management plan that addresses broad sustainability principles. Particularly as the Pacific Northwest experiences a regional crisis of both water and energy availability, it is an appropriate time to evaluate the need for such a broad platform.

As a result, (hereafter referred to as "SPU") recommend that the pilot hotels, as well as all area hotels, adopt a water management plan. To optimize performance, this plan should be adopted in the context of a broader sustainability action plan, thereby guiding future resource use and assisting the hotels in integrating economic planning with natural resource use and its impacts.

Why conservation matters

"Water is silky, dense, and poetic stuff. It's cohesive, yet it parts under pressure, eluding touch. On a recent trip to hot springs on the Peninsula, I had the opportunity to think about this. The delicate, sulphorous mist hanging above the pools was a substance that fit no category: Almost liquid, yet airborne, it was inhalable in its thousands of little microdots. The delicate mist's layers captured light and fell into diving currents, pulled by wind. Water is an indelible, continuous link between plants, animals and everything alive; this taut configuration seems at once startling as a dream and astonishingly real. At the same time, water is a frank necessity."

[Stacey Levine; "Watered Down," August 3, 2000. Reprinted with permission from the Seattle Weekly]

How can this be more beautifully stated, yet we treat water like an antiseptic topic, often losing sight of its miraculous qualities. It is the reason why we conserve for without it, nothing lives. Under drought conditions, this sense of urgency will be heightened. We must conserve because there is no "new" water, meaning that rain does not necessarily translate into potable drinking water. The hydrologic cycle is part of an ancient cycle of water of which only .05% is available for human and animal use on Earth.

Local Conditions and Sources

SPU and its purveyors -- the cities that provide water to residents, commercial and industrial businesses in Seattle and its surrounding areas-- protect public drinking water supplies by prohibiting commercial activities from taking place in their watersheds, and ensuring they are protected from outside access. Both the Cedar River and Tolt River watersheds, the

land area draining into these rivers, provide drinking quality water to over 1 million persons each day (estimated 150 million gallons/day).

The Limits to Expanding Water Supplies

In 1996, the Seattle City Council asked SPU to complete a *Water Conservation Potential Assessment (CPPA)* to review conservation potential. According to the Assessment, up to 31 millions gallons per day (mgd), or 16% of the water used between June and August, can be conserved each year within the next 20 years, with no reduction in customer's ability to use water and with satisfaction with services. It is difficult, if not highly unlikely, that SPU can develop new water sources outside existing ones due to geographical, political or financial limitations. Beyond 2013, based on current projections, water demand will exceed supply and conservation initiatives will be mandatory rather than voluntary.[1]

To complicate the region's 2001 drought conditions, the National Marine Fisheries Service (NMFS) the previous year had declared several species of salmon "threatened" under the federal Endangered Species Act (ESA), thereby invoking a series of measures to help in species' recovery. Providing minimum instream flows for salmon migration is essential to their recovery and accordingly, our conservation efforts play a crucial role in this recovery process.[2]

Benefits of Conservation

Since water is a shared resource between individuals, businesses, industry, farmers and wildlife, conservation assists in the development of sustainable communities, including a sound economic base from which to responsibly manage growth in the region.

- *Reliability:* Water efficiency, the same concept as water conservation, extends water resources and provides a measure of reliability for water resources. The time of year in which water demand is highest happens to coincide with the region's dry period, extending from June through September. Conservation measures will make less likely severe water restrictions

- *Postpone Rate Increases*

- *Decrease water costs by decreasing use (including sewer, heat, pretreatment, chemicals, energy)*

- *Ensure habitats for animals and ecosystems are maintained*

- *Your guests are paying attention to the manner in which the hotel uses water*

- *It is a fundamental platform of sustainable tourism*

- *Future generations depend on our intelligent use of water*

Water Management Principles

Water management applies not only to the equipment and physical processes that use water, but also the human and corporate influences on water use. Water management can be categorized as:

1. Loss reduction (leak detection in faucets and pipes)
2. Equipment and process water reduction
3. Water reuse (closed loop systems)
4. Demand reduction (through programs and incentives)

Reduction in water demand and use correlates to savings in chemical use, energy, treatment costs (wastewater), cooling and boiler use, and pretreatment.[3]

Set Goals and Performance Measures

Set forth specific goals that can be achieved within a discrete period of time. For instance, set department level reductions, expressed in gallons per day, gallons per minute and gallons per function (e.g.; cleaning, dishwashing, guest watering). Establish dates to achieve the goals and set priorities such that the easiest, referred to as "low hanging fruit," are accomplished first. Performance measures are the measures the hotel would establish to gauge whether its programs and conservation efforts are actually reducing net water use. Linking them with goals and priorities that are mutually developed can optimize their effectiveness.

Secure Upper Management Support

General managers, regional managers and the Chief Executive Officer (CEO) of the parent corporation must make a demonstrable commitment to water conservation and sustainability to ensure a water management plan works over the life of the hotel. This commitment needs to be more than just a generalized notion but ideally should be in writing, with goals, incentives and enveloped in a more comprehensive sustainability plan or EMS.

Please see the discussion below for more information on trends in sustainable tourism.

Develop a sustainability or Environmental Management Plan

Water conservation or efficiency is part of an overall environmental management plan for improving efficiency, reducing operating costs and natural resource impacts, thereby giving the hotel a central point around which to secure loyalty by both managers, staff and returning guests. A sample might be:

The [hotel] is committed to long-term water conservation, in the context of a broader environmental management plan. It is the policy of [ ] hotel to improve efficiency, reduce natural resource impacts and work through its staff, community and investors, to make continuous improvements in environmental performance.

Developing A Water Management Plan

1. Develop a Water Use Inventory

Using the information provided through the SPU pilot, collect all facility information, paying particular attention to meters, submeters, data logger results and review the hotel's facility operating schedules.

Conduct a Facility Survey: Conduct a walk-through of the hotel and:

- List all equipment and processes that use water
- Identify staff functions that use water
- Log consumption for each device and adjust flow rates for fixtures such as faucets to an average or typical flow rate
- Meter large equipment
- Record hours of operation for fixtures, processes and staff related functions (cleaning, thawing)
- From the project data in combination with your own, determine a daily facility consumption rate
- Note issues having an impact on water consumption such as leaks, policies (refilling drinking water when glasses are half full), single-pass cooling flows, outdated equipment. Record these.

Prepare Estimated Water Balance: Use the categories set forth in this report, including the behavioral aspects of water use (water use that is contingent on policy, training, habit or internal rules outside of the equipment itself). Develop a water balance for three periods: May to October; November to April and Annual (January-December).

2. Water Management Options

Evaluate Options: Options may include simple changes such as adopting a vigorous leak detection program, replacing toilet flappers, or changing the frequency in which guests are provided drinking water, or may be more involved, such as closing single pass systems and replacing equipment.

Perform Economic Analysis: You may consider extending your payback period for those management options that will yield longer term value, such as installing an ozone laundry system or replacing inefficient equipment that has a particularly high number of units, such as ice machines.

Estimate Total Cost of Water: Calculate the water, wastewater and sewer charges, seasonal costs, heating and cooling, chemical and other treatment costs (cooling tower, boiler feed) should be calculated using current prices. However, energy related expenses such as pumping and heating may need to be converted into unit costs.

3. Implementing the Plan:

Develop A Water Management Plan and Schedule: Establish priorities for your water management options and develop a work schedule that accounts for budgeting, delays, and seasonal impacts on ability to carry out the action (will high season occupancy interfere with the project?).

Communicating the Plan: Ideally, a letter of support from both the corporate CEO and the property's General Manager, should be distributed to all managers and staff, including the company's Board of Directors. This letter could set forth the priority of water conservation as a cornerstone of the company's environmental policies. Both hotels in the pilot have already adopted a wide range of environmental options, including lighting retrofits, energy management, proposed ozone laundry, changes in providing guests unsolicited drinking water, food donation and recycling. Given this progress, it is not a substantial step to encapsulate this progress and fold it into a broader policy that highlights water conservation.

For instance, Fairmont Hotels (previously *Canadian Pacific Hotels and Resorts*) developed its comprehensive environmental program by asking staff throughout the chain their opinions about the corporation adopting an environmental policy and programs. They overwhelmingly supported program adoption and have been instrumental in refining its policies and implementation over the last ten years. [4]

- Post signs in the back of the house.
- Establish department "green teams" that can engage in friendly competition to reduce water and other natural resource use. Make sure managers are involved, set clearly defined goals and communicate with sales and marketing so they are both engaged and informed about progress.
- Goals should be specific, measurable and achievable.
- Provide incentives to inspire cooperation. These incentives may vary from person to person and could include compensation time, time off, flex time, cash bonuses, gifts, public recognition, or increased control over work.
- Communicate about your progress through staff newsletters, bulletin boards, through paycheck inserts, special events and staff meetings. The West Coast Grand has routinely promoted water conservation and other issues in its associate newsletter, *The Grand Coaster*. In its most recent issue, it highlighted the region's water and energy crisis, giving tips for reducing impacts.
- Work with SPU, Seattle City Light and related agencies to help your associates conserve water and energy at home, as well as work.
- Ensure existing and new associates and managers read the hotels' new Water Orientation Manual.

Implement the Water Management Plan: Ensure that everyone knows what their role is with respect to the water management plan so responsibility is not shifted to other

associates and managers. Everyone in the hotel must have some role in the plan's implementation and success. Display the plan's progress in areas where associates and managers can chart reductions in water use and associated costs.

Monitor the Water Management Plan: Once the plan has been initiated, monitor reduction in water use by: (a) equipment; (b) process; (c) time of day; (d) function and (e) department. Make adjustments to your plan if required and develop internal procedures or implementation, evaluation and revision. These procedures should be shared with associates and managers outside the Engineering Department, and if it creates new work for them, should be developed with their input.

Notes

1. *Water Conservation Potential Assessment,* Seattle Public Utilities, May 1998. http://www.ci.seattle.wa.us/util or (206) 684-SAVE
2. King County Endangered Species Act homepage: http://www.metrokc.gov/exec/esa or 1-877-SALMO
3. *Facility Manager's Guide to Water Management,* Arizona Municipal Water Users Association Regional Water Conservation Committee and Black and Veatch, August 2000. http://www.amwua.org/fmgtwn.pdf and (602) 248-8482 (this report provided the basis for this section's work and SPU gratefully acknowledges AMWUA's work)
4. *The Green Partnership Guide: A Practical Guide to Greening Your Hotel,* Fairmont Hotels and Resorts, 2001. http://www.fairmont.com and (416) 874-2600

5.2 Promotion of Sustainable Tourism

Water conservation measures adopted by lodgings, which include hotels, motels, B & Bs/country inns, bungalows and cottages, are often undertaken coincident with a more comprehensive environmental management program. Agenda 21 for sustainable tourism was born in the wake of the 1992 Rio Earth Summit, occasioned in part by the growing realization that tourism had profound, and incontrovertible, effects on natural resources and economic growth.

Agenda 21 was designed and implemented by the World Travel & Tourism Council (WTTC), the World Travel Organization (WTO) and the Earth Council.[1]

Shortly after Agenda 21 became effective, Inter-Continental Hotels approached the Prince of Wales Business Leaders Forum in London to promote its recently adopted environmental initiative and urged the Forum to create a standing body to address environmental issues within the lodging industry.

It is now known as the International Hotels Environment Initiative (IHEI; www.ihei.org) and is supported by the largest hoteliers in the world, including Marriott Corporation, Hilton, Holiday Inn, Inter-Continental, ITT Sheraton, Starwood Lodging and American Express as its first corporate sponsor. IHEI fosters the development and practical implementation of sustainable tourism practices and enjoys a growing membership. [2]

Many of the domestic examples of environmental management or sustainable tourism practices, are the product of IHEI affiliation and/or the exploding market for ecotourism. The monikers "eco-tourism," "green tourism," "adventure tourism," "responsible tourism," "sustainable tourism" and "green travel" are frequently used interchangeably.

Most of the early models of sustainable tourism development were spurred by desires for foreign exchange as well as to capitalize on the ecotourist market. In many of these developing countries, natural capital is the primary economic base upon which earnings are predicated.

Domestically, largely economic considerations and gentle pressure from federal and state authorities motivate hotel environmental management programs. EPA's Office of Wastewater Management developed Water Alliances for Voluntary Efficiency, or WAVE, to engage hoteliers in water conservation measures. The Department of Energy sponsors the Hospitality Industry Forum on Energy Conservation (HIFEC), administered by Battelle and aimed at introducing energy efficient and effective lighting, equipment and other measures to the lodging industry. It was responsible for financing one-third of the microfiltration system for water re-use by Red Lion Central Laundry in Portland, Oregon (now owned by DoubleTree Inns).

More recent developments include EPA' Sustainable Travel and Tourism Program, [3] Resources for the Future's report on the environmental impacts of tourism, [4] The Conference Board's development of Business Enterprises for Sustainable Travel, [5] and the

Seattle/King County Convention and Visitor Bureau program on tourism and the environment. [6]

In several states, solid waste utilities have developed programs directed at lodgings for solid waste reduction and recycling. Domestic examples include the Green Key program in Portland, Oregon (Metro); waste prevention tips for hotels in New York City (NYC Bureau of Waste Prevention, Reuse and Recycling); pollution prevention tips for inns, hotels and B & Bs in Vermont (Vermont Small Business Development Center); Resort Recycling project in Minnesota (Minnesota Office of Environmental Assistance); Eco-Lodgical Waste Reduction Program (NC Department of Environment and Natural Resources); and the more ambitious Georgia Hospitality Environment Partnership which integrates cooperation from tourism associations, business, tour operators, recreation, arts and environmental groups.

Solid waste reduction taken in isolation is not enough to ensure successful programs. The more successful Asian, Canadian, Caribbean, and European models for sustainable tourism incorporate elements such as pollution prevention, supplier relationships, packaging reduction, energy efficiency, water conservation, materials use and reuse, composting and community relationships. These programs place the lodging in a pivotal role vis-a-vis the cultural and environmental milieu and give us a context through which to implement the hotel education demonstration project.

Finally, the Green Hotels Association, a stable of light manufacturers and distributors for environmental hotel products (e.g.; faucet aerators, bulk personal care dispensers), consulting firms and the few new companies whose Presidents came to their own personal epiphany (usually through a child or reading Paul Hawken's "The Ecology of Commerce") form the remainder of our domestic "green hotel" facilitators.

Placing Water Conservation in Context

"Another way to see [ecotourism] is as a tourism development which is sympathetic to, complements or is employed as a vehicle for conserving and sustaining natural and cultural environments and can be described as sustainable, green, or alternative tourism. Because cultural and natural landscapes are indivisible, ecotourism works at marketing to and attracting tourists to rare and beautiful ecosystem (*sic*) while still including cultural attractions."(Tanya Headley, 1995).

Accordingly, hotel water conservation can be viewed as the first step towards introducing responsible tourism to the tourist, and incorporating the principles of ecotourism into all travel venues. "Tourist" is broadly defined as any person who is experiencing a new sensation, experience or destination outside of their physical home and routine.

In Washington State, most hotel guests actually reside in the State and may therefore be more amenable to linking personal behavior and value-based purchasing with travel. "Value-based purchasing," means the purchase of goods and services by individuals or groups, which reflects the personal value system, beliefs, and morals of the consumer. For

those people unable or unwilling to invest publicly in companies, it is often the only means by which to direct personal destiny, speak through dollars and help to shape business behavior and outcomes. It is a very powerful tool that underscores the proliferation of socially responsible investing and green marketing. [7]
Water conservation ideally must be viewed within the larger context of urban green tourism, or responsible tourism, whereby both the guest and the lodging can play an active, positive role in improving the local environment and reducing tourism impacts.

Defining sustainable tourism and travel

- Planning, development and activities, including purchased products, that will ensure future generations they can meet their own needs
- Requires long term planning and defining a vision
- Involves every person in an organization
- Extends to every facet of the tourism industry, including hotels

Involving tourism and travel sectors in sustainability

- The sector is represented everywhere: lodging, food, recreation, national parks, culture, natural areas, interpreters, retail, transportation, banking and insurance
- It is universally connected to the physical and cultural environment
- Growth patterns are creating pressure on sensitive areas
- Balanced planning ensures long term economic stability and healthy communities
- Growing public demand for accountable, responsible business practices
- Can promote best practices and loyal customer base

Drivers of sustainability

- Enhanced public perception
- Customer appeal in that they can reward those businesses providing environmentally preferable services
- Avoids regulatory pressure if adopted voluntarily
- Individual control over local use of resources
- Economic incentives: green is lean and clean
- Diversifies tourism experience by meeting demand for greater educational experiences
- Public pressure and growing market demand, particularly in the NW
- Lack of interest in touring "devastated landscapes"

Notes

1. *WTTC* is an international organization comprised or 115 of the world's leading tourism and travel CEOs. Its purpose is to raise the level of tourism as a strategic economic and employment priority, develop policy to ensure sustainable development, with dedication to the more accurate analysis of the economic impacts of tourism, barriers to tourism

and promoting competition and open markets. WTTC partners with a related organization known as Green Globe, the environmental management program for travel and tourism companies. It was developed in 1994 by WTTC and has the support of over 20 international industry associations, representing thousands of businesses worldwide, the WTO, the United Nations Environment Programme and the Earth Council.
WTO, an intergovernmental organization, promotes tourism as a significant means towards peace and understanding, fostering international economic development and international trade. Its environmental section works to ensure that new tourism development is properly planned and managed to protect natural and cultural environments. The Earth Council is a non-profit developed to advance the implementation of the Earth Summit agreements. It enjoys support from international members drawn from business, politics, the sciences and non-governmental organizations.

2. *The International Hotels Environment Initiative*: 15-16 Cornwall Terrace, Regent's Park, London NW1 4QP, United Kingdom. 44 (1) 20 7467 3620 and www.ihei.org and info@ihei.org. They publish an excellent magazine, *The Green Hotelier,* which can be ordered by writing: IHEI Order, MMC, PO Box 148, Aldershot, Hants, GU12 4GN, UK or by writing ihei@mmcltd.com.

3. *Environmental Protection Agency*, Office of Policy, Strategic Sector Program, *Sustainable Travel & Tourism Program*, 401 M Street SW, Washington, DC 20460; (202) 260-2765.

4. *Resources for the Future*: http://www.rff.org; (202) 328-5121

5. *Business Enterprises for Sustainable Tourism:* BEST, Conference Board of NY, (212) 339-0335; best@conference-board.org and http://www.sustainabletravel.org

6. *Tourism and Environment Program*: Seattle/King County Convention and Visitors Bureau; http://www.seeseattle.com or tourism@pugetsound.org

7. The Green Money Journal: http://www.greenmoneyjournal.com; (505) 988-7423 and info@greenmoneyjournal.com

5.3 Using behavioral change to create a conservation culture

Creating a conservation culture

Conservation behavior is a learned, shared norm that is developed with the guidance, direction and support of the corporate office and other associates. Although it is fair to say that some unspecified number of people are interested in water resources, that generalized sense does not necessarily translate into direct conservation behavior, particularly at work, unless directly supported and encouraged by the employer.

Overarching Mission Necessary

In addition, piecemeal approaches to conservation can be confusing and reactive, such as when businesses adopt projects and temporary pilots in the absence of an overarching policy, mission, goals and measurable targets. For this reason, an ideal approach is to develop a facility wide conservation and sustainable tourism policy within which water conservation goals are easy to understand, incentivized and supported by the corporate office. To facilitate a conservation culture, one must reach beyond traditional engineering approaches to natural resource issues and evaluate the underpinnings of behavioral change.

Behavioral Change Research Findings

Traditional methods of environmental education, outreach and program activity predicate change based on providing information. The overwhelming body of behavioral science research suggests that information alone is rarely enough to change entrenched habits that have environmental impacts. [2]

The following basic guidelines should be used in developing water conservation projects:

1. Identify both internal and external *barriers* to change and remove or minimize them. If the corporate office has a short return on investment criteria that prohibits more expensive, but highly effective retrofits, work with them to change those criteria. Discuss how sustainable practice is economically preferable and help create a culture of opportunity and change.
2. Give people and the organizations they work in the *tools to change*: what's the issue, who to call, what to do. It can be as simple as giving out phone numbers and the authority to make change in each department, for each person's position.
3. Information must come from a *credible source* the receiving audience will listen to. Based on staff meetings, this might be the chief engineer, their peers, or the hotel magazines and periodicals read for current trends. Despite the trend in anti-governmental sentiment, local government is still considered a good source because it is relatively impartial and objective.
4. *Use champions from the same industry*. For the hotel sector, hotels will be more interested in what other lodging companies are doing. Accordingly, a case method approach would be useful in encouraging change.

5. *Tailor information* specifically to the sector and use the types of persons characteristic of that industry in collateral development.
6. Provide *immediate and regular feedback* to support the desired behavior. Remote feedback is less effective.
7. The *message should be frequent, positive* and the action framed such that the receiving audience believes it is losing something, as opposed to gaining something, as the result of not taking certain action (you lose by not practicing water conservation).
8. Use focus groups to ascertain whether "conservation" and "efficiency" impart the same meaning. Even though they are essentially the same, research findings suggest that the word "conservation" is viewed as having to sacrifice something of value, and therefore people are resistant to the notion.
9. Design methods and tools in such a manner that persons and the organizations they work in can "pay attention" to water efficiency and water demands in the *context of their daily experience*.
10. Gently permit people to recognize their own internal barriers to change and help *create well-designed social pressures and social norms* that favor water efficiency behavior, attitudes and practice.
11. Understand the audience's *unique perspective* and barriers to change.
12. *Use existing social networks* to diffuse information and use effective opinion leaders in the same organization and industry. [3]

Notes

1. *Center for Watershed and Community Health*; http://www.upa.pdx.edu/CWCH/ (503) 725-8101
2. *Environmental Problems and Human Behavior,* Gardner, Gerald and Stern, Paul. Allyn and Bacon, 1996. ISBN 0-205-15605-3
3. *Ibid, Chapter 4*

Blueprint for Getting Started

In addition to establishing a water management plan, take a more integrated approach to what programs, policies and trends the hotel property and its parent corporation have already adopted. Where do you see trends? Most will concern water and energy upgrades, and enhanced recycling. Given our regional water and energy crisis, the time is ideal to assess how these programs are related and to give them both a programmatic umbrella and extend participation to all managers and associates.

1. The role of the corporate office

To give your water conservation and related programs a secure and long life, the corporate offices, including all divisions, must actively support your goals. There may be instances where the corporate office is adopting policies that directly contradict your emerging conservation strategies. This can be avoided by ensuring both corporate and hotel policies support a conservation agenda that is economically sound.

2. Assess your current status

In addition to compiling your water inventory, you will want to answer the following questions:

Attitudes

- What is your current policy towards water conservation and related issues?
- What is the attitude of the corporate offices?
- What are the attitudes of those who support water conservation, those who are indifferent and those against it?
- What is the basis for apathy?
- What are the key issues involved getting commitment from associates to implement change?

Knowledge

- What do managers and associates know about water conservation opportunities?
- What are the barriers to producing a water conservation campaign?
- What are the threats to your plan? What makes it vulnerable?
- How water conservation savvy is other hotels in the state?
- What systems/equipment are hindering water conservation?
- How can you improve communication channels to promote your water conservation program?
- What other channels might you consider? (green teams)

Costs

- How have energy and water costs changed over the last 5 years?
- How have costs been apportioned throughout the organization?
- What would a 10% savings in water and energy costs mean to bottom-line contribution or increased service capacity?
- How are water and energy costs likely to change in the future, assuming no further program development?
- Have you evaluated total cost accounting and other ways to apportion utility costs?

Change

- What authority does each manager and associate have to implement the changes SPU and your hotel propose?
- Who has the authority to make change occur?
- Who has the desire to assist in making that change occur?
- What has happened thus far and failed? Why did it fail?
- What has happened thus far and succeeded? Why did it succeed?
- What influencing agents exist outside the hotel? Can they be harnessed to motivate everyone to conserve and find innovative ways to be efficient?
- Which departments can be helpful in implementing your plan? [1]

3. Define what direction you are going in

All the departments should gather to determine what the hotel's water conservation and related goals would be. After setting forth an environmental policy, work on developing a list of quantifiable, measurable outcomes you can aim for. They should be separated into both short term and long term goals. Set specific targets and implementing strategies for each goal. Make sure you define who will take the lead for each goal, how different leaders will collaborate and the communication methods you will use to achieve coordination.

More specifically, your outcomes should be: (i) simple and specific; (ii) measurable; (iii) achievable; (iv) realistic and (v) timely and track able. Each outcome should be supported by specific objectives.

Outcomes or Goals> Objectives> Targets
Measurement> Feedback loop> Revision

4. Communicate expansively

Water conservation goals cannot be achieved unless each and every associate and manager is aware of what these goals and objectives are. Consider the informal pathways by which associates and managers communicate -- it may be word of mouth, lunchroom conversation, journals, meetings, or outside socializing.

There is a correlation between home conservation and work conservation unless the employer establishes barriers. Work with SPU and City Light to establish small kits for your associates and managers so they can start adopting efficiency behavior at home. This will increase the likelihood of this behavior at work. [2]

1. Establish a written water conservation policy, goals and objectives
2. Distribute to all associates and managers
3. Convene a meeting that focuses specifically on water and energy issues
4. Ask associates for their opinions and whether they support the project
5. Establish green teams, and interdepartmental water wizard teams to help inspire, create, and enable associates to own the project and derive benefits directly when the goals are achieved
6. Ensure that associates, corporate offices and your guests understand what you are doing, why and what the results are
7. Communicate with investors and learn more about how the socially responsible investing community can affect your business and respond to what you are doing [3]

5. Determine your strategy

1. Ensure commitment from top levels
2. Appoint champions
3. Ensure organizational commitment

4. Promote water conservation as a corporate product
5. Reduce water costs without detriment to guests, associates, performance or quality
6. Monitor progress and provide feedback

The hotel's water conservation plan should be introduced in a formal roll-out or launch. Conduct a classic SWOT analysis; strengths, weaknesses, opportunities and threats. [4]

6. Tools to get there

Both hotels already have adopted informal and formal communication channels. The following tools will facilitate program adoption and participation:

- Presentations
- Articles
- Workshops
- Brown bag lunches
- Contests
- Internal training
- Videotape production
- Water and energy newsletters
- Posters
- Promotional gifts and prizes (*A weekend at Sleeping Lady?)*
- Sponsorship
- External publicity
- Public relations
- Support from local groups

Notes

1. *Marketing Energy Efficiency- raising staff awareness."* Good Practice Guide 172. Building Research Establishment: http://www.bre.co.uk/bre/otherprg/eebp/default.htm; brecsuenq@bre.co.uk ("*Brescu")*
2.*Id* at 8-9
3. *Green Money Journal:* (800) 318-5725. cliff@greenmoney.com. Given that sustainably managed companies provide a higher return on investment, investors are increasingly interested in, and acting on, the development of sustainable programs.
4. *Brescu* at 11

5.4 Cleaning Chemicals and Janitorial Pollution Prevention

Approach

During the course of the project, the team evaluated chemical use by both hotels to assess where consolidation, reduction in toxicity and elimination of certain constituents could take place. Several municipalities have adopted programs to reduce the use of toxic cleaning chemicals and are typically referred to as "janitorial pollution prevention" or janitorial "P2."

II. Background

Some of the chemical ingredients found in commercially available cleaning products predate the 1976 federal Toxic Substances Control Act (TSCA), meaning that thousands of industrial chemicals were grand fathered into the law and possibly never reviewed by federal agencies such as the Environmental Protection Agency ("EPA", or the "Agency"). EPA has jurisdiction over newly introduced, or post research and development commercial chemicals, but the current structure of the statute, which requires the Agency to balance the costs associated with toxicity testing with risk factors (cost-benefit), cannot ensure that these substances receive full toxicological review. [1]

Particular chemical substances found in cleaning products may cause a range of human health and environmental effects if exposure exceeds recommended levels. This can easily occur when cleaners are used in poorly ventilated areas and/or in the absence of personal protective equipment, such as gloves and dust masks. Many cleaning chemicals absorb readily through the skin within seconds of exposure.

Of particular concern to both local and national environmental and health agencies are chemicals that act as hormone disruptors, including the larger class of alkylphenol ethoxylates, or APEs. APEs are found in many cleaning chemicals and have been banned in several European countries while the National Science Foundation, EPA, USDA, Centers for Disease Control, NOAA, FDA are working to evaluate the risks associated with APEs.

Accordingly, janitorial P2 programs have been developed by non-profits such as the GreenSeal, Scientific Certification Systems, St. Paul Neighborhood Energy Consortium and the Washington Toxics Coalition; cities such as Santa Monica and Seattle and Massachusetts, Minnesota, and Vermont. [2]

Applicable Law

The use of chemicals and the manner in which the associated risks are communicated to exposed staff is governed by the Washington Industrial Safety and Health Act (WISHA) and the WAC (Washington Administrative Code): 296-62, Chapter C.

This reference is to the Hazard Communication Standard and is intended to:

1. Evaluate risks from chemicals
2. Train and educate the people who are exposed to them about these risks
3. Reduce worker injury and illness; lower insurance; comply with law

Responsibilities of Chemical Manufacturers and Importers

Chemical manufacturers and importers are required under this law to evaluate the hazards of their chemicals. Some of the product formulations may not even contain toxic constituents but this body of law has developed in such a way that they produce information about the product formulations even if they are not considered hazardous. Chemical manufacturers must provide a material safety data sheet, or "MSDS", with each first and subsequent shipment of chemicals.

The Hotel's Responsibility under State Law

The employer, the hotel, does not have to evaluate hazards from the chemicals it uses but it does have to:

1. Develop a Hazard Communication Program:

- Obtain and make available MSDSs 24 hours/day (since employees and contractor may be exposed at any time)
- Make sure the MSDSs are current and updated
- Prepare a written program that outlines: how the program will work at the specific place of work, meaning how the employees will be trained, including new employees, language translation and how staff will understand how to store, mix and use chemicals
- Containers must be clearly labeled, including Ready to Use (RTU) bottles
- Identify person or persons at work responsible for developing and implementing a workplace plan
- Procedures must be articulate regarding how MSDSs will be updated
- How the hotel will respond when MSDSs are not provided by the manufacturer/importer
- Employee education and training must be provided for all new employees, and when the hazard changes. This means that each time a new chemical is introduced into the workplace, training must be conducted for that chemical (storage, handling and use).
- **Training elements include:** (1) How employees can detect the presence of release of chemicals (odor); (2) physical and health hazards of hazardous chemicals in the workplace; (3) how to protect themselves (gloves, face masks, ventilation); (4) details of the Hazard Communication Program you have developed
- **Information you must provide**: (1) the Hazard Communication Standard requirements; (2) operations that involve hazardous chemicals (F&B, laundry, engineering, housekeeping) and (3) location and availability of the written program including MSDSs.

MSDS Requirements

- All spaces must be filled in
- Do not accept chemicals where the chemical identity is proprietary. Legally the company can make trade secret claims but as a matter of policy, you should not purchase chemicals with these claims
- If you do purchase chemicals with such trade secret claims, there must be an 800 number to call 24 hours a day in case of exposure
- Labor and Industries can help provide MSDS translation for Cambodian, Chinese, Korean, Spanish and Vietnamese
- MSDSs must be maintained for 30 years

Contractors must provide MSDS to you for chemicals they bring into the workplace and the hotel must do the same for them Findings

Not unlike most businesses, both hotels use a wide range of cleaning chemicals including toilet bowl cleaners, all purpose cleaners, metal finishers, laundry and F&B chemicals and sanitizing agents. The team, in conjunction with the Washington Toxics Coalition, reviewed the MSDSs for most of the chemicals used in both hotels, and also conducted research at the Hazardous Waste Management Program in King County library databases. Scientists in King County, EPA headquarters and the Washington Toxic Coalition were consulted throughout the process.

Of the chemicals used, approximately sixty-seven chemicals, if analyzed critically, would fail the janitorial cleaning chemical criteria adopted by the City of Seattle. [4] The basis for failure include:

1. corrosivity
2. hormone disruptors
3. flammable
4. phosphates
5. EDTA (chelating agent which attracts heavy metals)
6. carcinogens
7. reproductive toxicants
8. combination cleaner/disinfectant

See *Appendix 10* for the list of chemicals.

Alternatives

Given the national purchasing contracts established by corporate offices, it may be difficult for the hotels to purchase alternative cleaning chemicals. Products that meet the City of Seattle's criteria, which are in turn based on the work of several other jurisdictions, will provide a list of sources. Those sources may be found through the Office of Sustainability

and Environment and can be found on-line at
http://www.ci.seattle.wa.us/oem/greenpurchasing/envcritjanitorialservices.doc.

The team recommends that both hotels work with their suppliers and ask them to phase out the constituents the City of Seattle has identified as posing unreasonable risks to human health and the environment.

Washington Toxics Coalition Presentation

In March 2001, Dr. Philip Dickey of the Washington Toxics Coalition gave a presentation to both hotels concerning janitorial chemicals. General managers, housekeeping, laundry, rooms division managers and banquet facilities managers attended the meeting. Dr. Dickey distributed the text below to the hotels.

Chemical Hazards

- Flammability
- Reactivity
- Toxicity (includes human and environmental)
- Corrosivity

Hazard and Risk

Risk = hazard x exposure x susceptibility*
*Populations with increased susceptibility
children
elderly
pregnant women
chronically ill
chemically sensitized

Routes of Exposure
Ingestion
Inhalation
Skin/eye

Ingredients of Concern

Concern	Ingredients	Products	Mitigation
Skin/eye burns	Acids, bases, concentrates	Toilet, oven, drain Floor stripper Conc. laundry & dishwasher detergents Bleaches Rust removers	Product selection Avoid contact with concentrates Gloves & goggles
Resp. irritation and asthma aggravation	Bleach, ammonia, solvents	Laundry bleaches, some bath, toilet cleaners, glass cleaners	Product selection Ventilation Respirator
Cancer	Trichloroethylene Perchloroethylene Silica	Dry cleaning fluids Metal polish, spot remover, scouring powder	Process changes Product selection Dust mask
Reproductive effects	Some glycol ethers:* EGME, EGEE, EGDME DEGME, DEGDME	Many products	Product selection Gloves
CNS effects	Solvents: toluene, glycol ethers*		Product selection Ventilation Respirator
Blood, bone marrow damage	Glycol ethers*	Many products	Product selection Gloves
Water pollution	Phosphates	Laundry, auto dish	Product selection Use reduction
Aquatic toxicity	APE detergents (nonyl, octylphenol ethoxylates)	Many products	Product selection
Air pollution, smog	Volatile organic compounds (VOCs)		Product selection Use reduction

*Note: glycol ethers are readily absorbed through the skin. Skin contact increases exposures levels significantly and can be the major route of exposure.

Criteria for Product Purchasing

(blank cell means no specific criterion)

Criterion	**City of Seattle Janitorial Products**	**Green Seal Standard for I&I Bath, GP, and Glass Cleaners**
Hazardous chemicals	No SARA Title III Section 313 listed chemicals	
Toxicity		Must not be toxic
Corrosivitity	prohibited	May not be irritating or corrosive
Flammability	FP > 140	FP > 150
Reactivity	prohibited	
Carcinogens	Prohibited	Prohibited
Teratogens	Prohibited	Prohibited
Phosphates	<.5%	<.5%
Prohibited ingredients	APEs paradichlorobenzene 1,4-dioxane sodium hypochlorite (except in disinfectants) nitrilotriacetic acid sodium EDTA phosphates >0.5%	APEs dyes fragrances (except if active ingredients) sodium EDTA phosphates >0.5%
Aquatic toxicity		May not be toxic
Biodegradability		>60% max CO2
VOCs	<10%	<5% g.p. and bath <8% glass
Ozone depleters	Prohibited	prohibited
Cleaner/disinfectant	Must be separate	

Risk Reduction Strategies

1. Train workers about chemical hazards (training, MSDS info, injuries)

2. Wear protective devices (e.g. gloves, respirators)

3. Reduce unneeded chemical inventory
    - Eliminate duplicate products, consolidate, use up

4. Analyze cleaning procedures
    - What is the goal of each procedure?
        - Level of cleaning required
        - Success, failure, or overkill
    - Daily versus weekly cleaning protocols
    - As-needed versus timed protocols
    - Same guest versus new guest
    - Give the guest a choice to skip specific services
    - Focus on entryways, keeping soil out of building

5. Purchasing less-hazardous products

6. Contact Business Waste Line (206-296-3976) for more information
    - Hazardous waste disposal
    - Facility audits
    - Alternative products

What's in it for you?

*Less chemical use = lower costs
*Less storage space required for chemicals
*Fewer worker complaints and injuries
*Positive environmental message for guests

6.0 Summary and Follow-up

Substantial water conservation opportunities were identified. Many of these water conservation opportunities also provide opportunities for energy conservation. For each of the two hotels audited, potential water savings equaled approximately 1/3 of current water consumption. However, for the Westin, which is an older facility, close to 90% of the projected savings were from equipment measures, while for the West Coast Grand, close to 90% were for "behavioral" measures, primarily related to operation of heating and cooling equipment.

A comparative chart showing usage in gpd per room is provided in the Appendix. Pie charts are also included showing projected savings by measure for each hotel.

Evaluation:

In six months to one year, it will be necessary for SPU to evaluate the progress the hotels have made with respect to their water conservation programs. Such an analysis will provide SPU with valuable information:

1. Did SPU's pilot work achieve its goals more broadly?
2. Did the report and the activities of the project increase literacy?
3. Is a sector approach more effective in increasing water conservation?
4. Who should SPU work with to enhance water conservation in hotels?

Possible Evaluation Methods:

1. **Surveys:** Develop surveys for hotel managers and associates to assess their reaction to the projects.
2. **Telephone calls:** Call hotel managers to assess whether the project has changed water use in the hotel.
3. **Conduct informal associate meetings:** Ask hotel associates what they think progress has been regarding water conservation, including their reaction to SPU's outreach and education efforts.
4. **Water and sewer consumption:** Compare baseline water, sewer and chemical use to calculate reductions in water use. Calculate every month.
5. **Cooling water conductivity readings:** This measures the total dissolved solids for cooling towers and is an indicia of efficiency and water use.
6. **Record guest observations:** Have the hotels keep records of the verbal and written comments regarding water and energy issues, and specifically with respect to the water conservation programs.
7. **Transmit comments received by the City:** Assess whether there is an increase of comments received by SPU concerning hotel water conservation efforts generally, or more specifically with respect to the pilot hotels. Share with the hotels.
8. **Performance appraisals:** Assess whether adoption of water conservation and related programs has increased the overall satisfaction of managers and associates with their

positions and their attitudes towards the hotel. Determine whether there is any correlation between program adoption and decrease in turnover.

9. **Connection with home water use:** Ask for a representative sample of associates and managers to help SPU assess whether program adoption had any effect on water consumption at home and for personal uses.
10. **Hotel Inquiries:** Record frequency of prospective guest and convention groups that request information on the existence of water conservation programs.
11. **Develop performance indicators and use them:** These are standards for measuring how well any program, including this pilot, has met outcome objectives. Each performance measure should tell SPU when change is expected, how much change is expected and how we will know when change has actually occurred.

Follow-Up

SPU may wish to consider developing a communications strategy to transmit this report to interested parties and collaborate with them to refine the pilot's approach. Potential interested parties include:

1. American Hotel and Motel Association
2. American Water Works Association
3. Business Enterprises for Sustainable Travel
4. EPA Region X and EPA's Sustainable Travel & Tourism Program
5. Fairmont Hotels
6. King County Department of Natural Resources
7. Oceans Blue Foundation
8. Pacific NW Pollution Prevention Resource Center
9. People for Puget Sound
10. Resources for the Future
11. Seattle Hotel Association
12. Seattle-King County Convention and Visitors Bureau
13. Select water utility districts
14. SPU's Water Purveyors
15. Washington State Department of Ecology
16. Washington State Hotel & Lodging Association
17. Washington State Public Utility Districts
18. Water Alliances for Voluntary Efficiency- EPA
19. WaterWiser

Appendix 1

HOTEL WATER CONSUMPTION ANALYSIS PROJECT

CASE STUDY REVIEW

Prepared for

City of Seattle
Seattle Public Utilities

By

The RICE Group, Inc.

September 1999

HOTEL WATER CONSUMPTION ANALYSIS PROJECT

CASE STUDY REVIEW

September 1999

Prepared for

City of Seattle
Seattle Public Utilities

The RICE Group, Inc.
19015 36th Ave. W., Suite E
Lynnwood, WA 98036
Tel: 425-774-3829
Fax: 425-672-2084
Email: ricegroup@aol.com

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EXECUTIVE SUMMARY

The City of Seattle has established as a goal a 1% reduction in water use per capita per year for the next 10 years. As part of this effort, Seattle Public Utilities is initiating a pilot program to demonstrate water savings potential in the Seattle Hotel/Motel industry.

Purpose: The purpose of this Case Study Review is to review available literature dealing with water conservation opportunities for hotel properties in order to:

- Collect baseline data on hotel water usage
- Identify factors associated with increased water usage at specific hotels
- Collect information on water conservation measures proposed for a variety of hotels along with associated savings potential
- Provide insight as to the most useful information which could be gathered by the pilot program.

Selected Studies: Three in-depth studies of water usage at hotel/motel properties were identified, including:

1. 1998 study prepared by the Greater Vancouver Regional District, based on field inventories of water consuming fixtures and equipment at 26 Vancouver, B. C. area hotels.

2. A 1990 study prepared for the American Hotel and Motel Association and the School of Hotel Administration at Cornell University. This study was based on the results of a questionnaire sent out in 1988 to 1600 hotels, with 408 valid responses.

3. A 1991 study prepared for the Los Angeles Department of Water and Power detailing water conservation potential for the downtown L. A. Hilton.

In addition, several baseline studies of water usage at commercial facilities have been identified which provide a breakout of data for the hotel/motel industry. These include:

4. A 1994 study by the East Bay Municipal District which included information from 50 on-site surveys of hotels/motels.

5. Local water utility studies of hotels located in Phoenix (4), Denver(2), and Ventura(1), CA as reported in a 1992 article in the Journal of the American Water Works Association.

Findings and Conclusions: Total water usage across a wide variety of hotels ranges from under 100 gallons per day per room (gpd/rm) to over 400 gpd/rm. Older, luxury hotels and hotels with full service restaurants and on-site laundry facilities typically exhibit the highest water usage per room.

Water conservation measures identified as having the highest savings potential include:

- Installation of faucet aerators
- Replacement of showerheads with low flow models
- Retrofit or replacement of non-water conserving toilets and urinals
- Elimination of once-through cooling
- Laundry water recycle
- Dishwasher upgrades
- Repair of leaks
- Education of staff and guests in water conservation opportunities

Identified savings potential also varied widely, from 0% - 45% of total usage, with between 10% - 20% taken as typical. However, little documentation was provided on savings actually realized. Also, although process use improvements for cooling, laundry, and kitchen use were occasionally identified as having substantial potential, attention was not consistently given to this potential, or to the potential provided by leak detection and repair. These shortcomings may largely be attributed to the lack of sub-metering data necessary to highlight savings potential in process (non-domestic) usage. In this light the following recommendations are made for future studies:

- Process improvements should be given equal consideration with domestic retrofits.
- Leak detection should be more thoroughly performed
- Sub-metering should be used wherever practical to highlight inefficient processes and to document actual savings.

I. INTRODUCTION

1. Background

The Hospitality Industry as a whole is generally considered to be an intense user of resources, consuming large quantities of water, energy, paper, plastics and other products and materials. Resource efficiency has not been a priority in most hospitality operations unless such efficiency can provide a quick return on investment and will not, either by perception or otherwise, compromise guest comfort and satisfaction. Resource efficiency professionals, both internationally as well as domestically, agree that the Hospitality Industry represents a large untapped resource efficiency sector, capable of dramatic progress with the implementation of several cost effective, off the shelf technologies.

2. Project

The Hotel Industry in particular represents significant resource consumption and at the same time tremendous opportunity for efficiency improvements. Seattle Public Utilities recognizes that by working closely with hotel employees and management while providing sound analysis, engineering, product testing and recommendations, and economic justification, many cost effective water conservation projects could be implemented in hotels that would achieve significant water savings and excellent return on investment to hotel owners.

3. Scope of This Report

This Case Study Review is intended to provide a review of available literature dealing with water conservation opportunities for hotel properties in order to provide baseline data for comparison of water use among hotels, to identify criteria which could be used to highlight hotels with higher water savings potential, and to identify water conservation methods which appear to have been most promising in other locations. It is also intended to provide insight as to the most useful information which should be gathered as a part of a pilot implementation.

Specific performance data on fixtures and appliances, as well as identification of new and innovative equipment with applications directly to the hotel industry will be covered in a separate Technical Resource Manual.

II. OVERVIEW OF SELECTED STUDIES

1. Greater Vancouver Regional District, 1998

This report titled "Study of Water Consumption and Conservation Potential in Greater Vancouver's Hotel Industry" was conducted by the Greater Vancouver Regional District, and is based on information collected at 26 self-selected Vancouver, B. C. area hotels. Inventories of water consuming fixtures and equipment were used to estimate water used for various end uses. However, at only three of the hotels was detailed information collected on air conditioning, refrigeration, or other process use. Overall water consumption was provided from billing data. No sub-metering was used.

Data was analyzed based on hotel size, hotel age, and by end use. Five end categories were used: Domestic (35%), Laundry (10%), Kitchen (11%), Irrigation (1%), and Other (43% - attributed primarily to cooling). Larger hotels consumed more water per suite than smaller hotels, attributable primarily to increased usage in the "Kitchen" and "Other" categories. Older hotels consumed more water than newer hotels.

Water consumption per suite ranged from 98 gpd to 423 gpd. For domestic use only, consumption per suite ranged from 57 gpd to 152 gpd. The "Other" category encompassed the widest range, from 5 gpd to 246 gpd, which appeared to be associated with use of once-through cooling water for coolers and ice makers (variously used in 23 of the 26 hotels).

Category	**Min. gpd/rm**	**Max. gpd/rm**	**Median gpd/rm**	**Comments**
Domestic	57	152	73	Includes all staff, public, and guest washrooms.
Laundry	10	72	28	Only those hotels doing all laundry on site included. (17 out of 26)
Kitchen	3	73	17	Only those hotels with a kitchen included. (22 out of 26)
Irrigation	0	14	0	Reflects moderate climate of B. C.
Other (inc. HVAC)	5	246	79	Category with greatest range. High correlation with use of once-through cooling water (OTCW)
Total Use	98	423	190	

Table 1. Water Consumption per Suite by End Use Category, Vancouver B. C.

These figures were derived from inventories of fixtures and equipment multiplied by estimated usage factors, rather than from actual sub-metering. Results are therefore expected to be much more reliable for the "domestic" category, where fixture numbers are large and usage factors are more standard and quantifiable, than for the various other categories which involve smaller numbers of fixtures or pieces of equipment, and for which usage factors are much more difficult to ascertain. This also made it most straight forward to

identify and provide cost/benefit analysis for water conservation opportunities in the "Domestic" category.

The following recommendations were made, followed in parentheses by the number of hotels for which each recommendation applies:

- Request guests have linens washed less frequently (all)
- Install toilet volume reducers (18)
- Install faucet aerators (17)
- Install low flow showerheads (14)
- Replace automatic flush urinals with manual or sensor models (6)
- Reduce or eliminate use of once through cooling water (2)
- Install rain sensor on irrigation system (1)
- Repair leaky faucet (1)

As shown above, most of the identified savings potential appear in the "Domestic" category, despite the face that this category represents only 38% of the mean use. Disregarding the recommendation concerning frequency of washing linens (which is behavioral rather than technical) out of 59 recommendations, only 4 applied to non-domestic use. No follow-up data was provided to show actual savings which may have been realized as a result of this study.

2. American Hotel and Motel Association, 1990

"Water Consumption in the Lodging Industry", prepared for the American Hotel and Motel Association and the School of Hotel Administration at Cornell University, by Redlin and deRoos,1990. The results of this study are included in the book, Water Resources for Lodging Operations, by Stipanuk and Robson, published by the American Hotel and Motel Association.

This study is based on the results of a questionnaire sent out in 1988 to 1600 hotels, with 408 valid responses. This report is particularly interesting in that several hotels also supplied information based on sub-meter readings for laundry, kitchens, irrigation, cooling towers, and pools (generally from deduct meters).

Median water use per room was reported at 144 gallons per day. This ranged from a median of 101 gallons per day (gpd) for smaller hotels (less than 75 rooms) to a median of 208 gpd for hotels with 500 or more rooms. Additionally, Limited Service/Economy hotels reported a median use of 94 gpd while Resort/Casino/Conference Centers reported a median of 254 gpd.

From sub-metering data, the following information was compiled:

On-Site Laundries
Twelve hotels, ranging in size from 251 rooms to 2033 rooms (with a median of 643 rooms) provided sub-metering data for laundries. For this group, laundry water accounted for between 5% and 30% of total water use, with a median of 14%. Efficiency ranged from 1.0 to 5.9 gallons of water per pound of laundry, with a median of 2.4. Daily pounds of laundry per guest room ranged from 6 to 19 pounds, with a median of 10.

Kitchens
Ten hotels provided sub-meter data for kitchens. For this group, kitchen water use ranged from 0.05% to 25% of overall water use, with a median of 6%. Gallons per meal ranged from 2.4 to 15.8, with a median of 12.0.

Irrigation
Thirteen hotels provided data on irrigation, with usage accounting for between 1% and 44% of total water use, with a median of 14%. The one hotel located in Washington State (a 5 acre, 301 room luxury hotel at an airport location), reported using over 5,000 gallons per day, or approximately 18 gallons per room per day (10% of overall use).

Cooling Towers
For 17 hotels, cooling towers consumed between 1% and 21% of total water use, with a median of 9%.

Swimming Pools
For 16 hotels, swimming pools consumed between 0.01% and 13.1% of total water use, with a median of 0.16%.

Much has changed in the way of available and mandated plumbing fixtures since the time of this study. It was noted that many of the respondents considered 4-5 gallon per flush (gpf) toilets to be water conserving devices, compared to previous 7 gpf models.

General recommendations included installation of low flow showerheads, faucets and toilets; irrigation improvements,; and control of high-volume uses such as dishwashers, laundries, and cooling towers. However, no follow up was provided to show any actual savings attributable to this study. Nevertheless, given the low number of studies using actual sub-metering data, this portion of the data may still be quite useful for benchmarking especially in laundry and kitchen areas.

3. Los Angeles Department of Water and Power, 1991

"Water Conservation Survey, Hotel Customer Category", (Hilton Hotel, Downtown L.A.), Los Angeles Department of Water and Power, 1991 .

This survey was conducted in October 1990 at the 900 room Hilton Hotel in Downtown L.A. The average daily water consumption from January through December was 241 gallons per room. Of this, 30% was for HVAC (primarily cooling tower evaporation), 27% for Kitchen & Laundry, 20% for Showers, Toilets, Urinals, & Sinks, 8% for Pool & Exterior, 5% for Clean-up, and 10% for Misc.

This hotel had already taken many water conservation measures including replacement of all showerheads with 2.75 gpm models, replacement of toilet and urinal flush valves with low flush models, replacement of high use faucets with auto shut-off models with aerators, replacement of open circuit cooling tower with an air-cooled, closed circuit tower.

Study recommendations included (1) replacement of all remaining 1.5 gpf urinal flush valves with 1.0 gpf models, (2) replacement of all (3.5) gpf toilets with 1.6 gpf models, (3) education of staff on water conserving techniques, (4) replacement of the main dishwasher with a newer, more water efficient model, and (4) retrofit existing washing machines with a mechanism to recycle rinse water. It was estimated that these measures would save 16 million gallons of water per year (49 gallons per room per day), saving $85,000 annually, with a payback of 3.0 years. This would represent a 20% reduction in total use. Limited post-implementation follow-up was provided.

4. East Bay Municipal Utility District, 1994

"Water Conservation Baseline Study", East Bay Municipal Utility District (EBMUD), 1994 (http://www.ebmud.com/watercon/baseln.html)

This study is based on the results of 500 telephone interviews, and on 657 on-site surveys, including 50 on-site surveys of Hotels/motels. For the hotels, it was determined that 46% used water for heating/cooling, 20% used once-through cooling, 88% operated laundry facilities, and 80% operated kitchens. Additionally, 3% of hotel toilets flushed with 1.6 gallons, 61% with 3.5 gallons, and 36% with 5.5 gallons. For showers, 52% used 3.0 gpm or more. For faucets, 39% used 3.0 gpm or more. No measurements or estimates of total water use was made, nor were any conservation recommendations made.

Flush Volume	Distribution - Toilets
1.6 gpf	3%
3.5 gpf	61%
5.5 gpf	36%

Table 2. Flush Volume Distribution for Hotel Toilets, EBMUD

Flow Rate	Showers	Faucets
< 3.0 gpm	52%	39%
≥ 3.0 gpm	48%	61%

Table 3. Flow Rate Distribution for Hotel Showers and Faucets, EBMUD

5. Studies by Other Public Utilities

"Nonresidential Water Conservation: A Good Investment", Jane H. Ploeser et al, Journal AWWA, 1992

This article cites results of site visits to 7 hotels located in Phoenix (4), Denver (2), and Ventura, CA (1). For these 7 hotels, Domestic Plumbing accounted for 24% of use, Cooling towers 14%, single pass cooling 7%, Clean-up 3%, Laundry 12%, Kitchens 12%, Irrigation 22%, and Miscellaneous 6%. No information was given on use per room, nor were any conservation recommendations given.

FINDINGS & CONCLUSIONS

Factors Affecting Overall Usage

The number of hotel specific water conservation studies is somewhat limited. However, considerable variation in water use by various hotels has been documented, with annual averages running from under 100 gallons per day (gpd) per room to over 400 gpd per room. Age, size, class of hotel, type of cooling (especially use of single pass cooling), use of on-site laundry facilities (vs. off site), and the existence or absence of full service restaurants catering have all been shown to have a significant effect on total water use.

	Vancouver Reg. Dist.	AHMA	L.A. Hilton
Smaller	150	101	
Mid Size	135	153	
Larger	260	208	241
Newer	145		
Mid Age	195		
Older	235		241
Economy		94	
Mid Range		153	
Luxury		254	241
Median	190	144	
Range	98 - 423	71 - 339	241

Table 4. Avg. Total Usage in gpd/room by Hotel Size, Age, and Class

Most of these studies involved self-selection of one type or another, rendering them unreliable for establishment of statistical means. Taken together, however, they should provide a reasonable picture of general trends and the range of usage which may be expected.

Consumption by End Use

Percentage of water used by end use category (domestic, kitchen, laundry, etc.) likewise varies considerably, but is less reliably documented. Most studies provide estimates based primarily on a fixture and equipment inventory. In only one study cited here is usage by category based on actual sub-metering, using data from deduct meters already in place. Excess usage caused by leakage or by poorly operated or maintained equipment, though potentially significant, has generally not been addressed.

These studies have also focussed most closely on the "domestic" category, reflecting usage attributed to showers, lavatories, toilets and urinals. Given the large number of these easily countable fixtures at any particular hotel, together with the availability of relatively constant and reliable usage factors which may be applied to each fixture, inventory based estimates appear fairly reliable in this category. However, domestic usage typically accounts for only around one third of total usage.

Other significant end use categories include cooling, with usage ranging from 0% - 50% or more of total usage; laundry, typically ranging from 5% - 25%; and kitchen, ranging from less than 5% to more than 50%. Irrigation may be significant depending on location. Usage for facilities such as pools, spas and fountains generally does not appear to be significant. As mentioned previously, leaks may sometimes be significant but have not been seriously addressed in any of the studies cited here.

	Vancouver (Avg.)	Vancouver (Range)	AHMA (Range)	L.A. Hilton
Domestic	35%	22 – 88%		25%
Kitchen	11%	0 – 18%	0 – 25%	27% Combined
Laundry	10%	0 – 22%	5 – 30%	
Irrigation	1%	0 – 13%	1 – 44%	8%
HVAC/ Other	43%	3 – 58%	1 – 21%	40%

Table 5. Usage in percentage and gpd/room by end use category as reported by 5 sources

Projected Savings

Two of the cited studies provide site-specific recommendations for hotel water conservation measures, but with very little follow up data documenting actual savings. Suggested measures include installation of low flow faucet aerators and showerheads, upgrades to toilets and urinals (addition of displacement devices and replacement of flush valves and/or fixtures), upgrades to process equipment (including washing machines, dishwashers, and cooling towers), elimination of once-through cooling, use of drip irrigation, and detection and repair of leaks.

Savings projections range from 0% to 45% for individual hotels, with most falling within 10 - 20%. (See **Table 3**.) The greatest savings projection (45%) was related to domestic upgrades to one of the oldest hotels, which had implemented no previous water conserving measures. The next greatest projected savings (33%) was related to elimination of once-through cooling, at a different hotel. However, without adequate follow up data it is often difficult to judge how reliable specific projections may be.

	Vancouver Reg. Dist.	L.A. Hilton
Domestic	0 – 45%	13%
Kitchen	0 – 4%	1%
Laundry	0%	5%
Irrigation	0%	0%
HVAC/ Other	0 – 33%	0%
Total	0 – 45%	19%

Table 6. Savings Potential in percentage of total usage, by end use category

(Note: Significant savings potential for specific processes has also been documented elsewhere, including through programs initiated by Seattle Public Utilities regarding laundry water recycling and cooling tower improvements.)

Conclusions

Considerable variation exists in water usage among hotels. Age, size, class of hotel, type of cooling (especially use of single pass cooling), type of laundry facilities, and the existence of full service restaurants catering have all been shown to have a significant effect on total water use. Older, luxury hotels typically use the greatest quantity of water per room.

Annual averages for hotel water use run from under 100 gallons per day (gpd) per room to over 400 gpd per room. End use may be categorized as either "domestic" (toilets, urinals, showers, and lavatories) or "process" (all other uses). Domestic use typically accounts for around 1/3 of total use, and is typically between 50 and 150 gallons per day per room. The remaining 2/3 is attributed to various process uses, primarily: cooling, with usage ranging from 0% - 50% or more; laundry, typically ranging from 5% - 25%; and kitchen, also typically in the range of 5% - 25%. Irrigation may sometimes be significant, depending on location. Usage for facilities such as pools, spas and fountains generally does not appear to be significant. Leaks may be significant but were not seriously addressed in any of the studies cited here.

Projected savings range from 0% to nearly 50% for individual hotels, with around 10 - 20% being typical. However, adequate follow up data was not generally available to show how reliable specific projections may have been. Hotels with the highest savings potential tended to be older. Medium sized hotels generally showed lower potential, with both smaller and larger hotels showing increased potential.

Suggested conservation measures have included installation of low flow faucet aerators and showerheads, upgrades to toilets and urinals, upgrades to process equipment (including washing machines, dishwashers, and cooling towers), elimination of once-through cooling, use of drip irrigation, and detection and repair of leaks. However, the great majority of recommendations in the studies cited are focussed on domestic upgrades.

The most obvious shortcomings in the studies cited include a primary focus on upgrades to "domestic" fixtures (representing around 1/3 of total use), with a corresponding lack of focus on process equipment or leaks. Additionally, there is a lack of follow-up data correlating actual savings with projected savings. Both of these shortcomings appear related to lack of sub-metering data to accurately test specific process equipment or to accurately measure results. Based on this, it is suggested that future studies use sub-metering be used where practical, that process upgrades and leak detection be given equal attention to upgrades of domestic fixtures.

July 27, 1999

Review of Domestic Hotel Water Efficiency Measures

I. Background

This document provides the reader with an abbreviated background on preferred methods of behavioral modification and summarizes the initial contacts made under Task 1 of the Seattle Hotel Education Demonstration Project. During mid-April through early July, 1999, over 47 non-profit organizations, academic institutions, water authorities and hotels were contacted in various parts of the United States to collect raw data on water conservation and what, if any, tools were employed to help change water consuming behavior.

In the context of this project, *water conservation measures* are considered those methods, tools, and hardware used to promote water efficiency that is distinct from and indirectly affected by the attitudes, behavior and other propensities of the human beings who use such hardware or systems. In contrast, for purposes of Task 1, telephone calls were made to assess what behavioral modification methods were effective in changing water consuming behavior. This raw data collection did not address the methods used that might affect organizational propensity to adopt such tools.

Unless otherwise noted, if no information was available or contact could not be made, only a name and/or address will appear.

II. Changing Behavior: Preferred Methods and Tools

What follows are basic guidelines to change behavior based on applied research findings. A basic premise of behavioral change with respect to environmental impact is to link attitude and knowledge with behavioral change. Effective behavioral change is, in part, amplified when the value of the commodity, in this case, water and its representations, are positive values embraced by the individual or organization.

In the absence of an articulate, senior management supported environmental policy, requisite organizational and culture shifts cannot take place or be sustained over a prolonged period of time despite well-intentioned and intelligent individual behavioral change. Education efforts to promote water efficient behavior will be more effective if the methods and tools:

1. Ensure changing behavior is made relatively easy, with external barriers minimized or removed (e.g; cannot find technical information, your management doesn't support change, the equipment required to change behavior is too expensive);
2. Give people and organizations the tools to make change (knowing who to call to promote water conserving policies or to facilitate rewarding those who are responsible for beneficial change);
3. Ensure the information comes from a credible source that the receiving audience will listen to;
4. Use local champions from the same industry;
5. Tailor information specifically to each receiving audience and feature the same "type" of people engaging in the desired behavior;
6. Provide immediate and regular feedback to support the desired behavior. Theories of operant conditioning based on the classic B.F. Skinner studies indicate that remote responses, either negative or positive, are not as effective as immediate feedback;
7. Ensure the message is frequent, positive and the action is framed such that the receiving audience believes it is losing something, as opposed to gaining something, as the result of not taking certain action (e.g.; you are throwing away a sum certain by not using water efficient behavior);
8. Frame the message as "efficiency" as opposed to "conservation" since the latter implies a sacrifice;
9. Are designed in a manner that allows the person or organization to "pay attention" to water efficiency and water demands in a way that speaks to their everyday experiences and overcomes the tendency towards inertia;
10. Are framed such that the recipients believe it was their own idea rather than foisted upon them by an outside regulatory force;
11. Gently permit people to recognize their own internal barriers to change and help create gentle social pressure and social norms that favor water efficiency behavior and attitudes;
12. Are based on an understanding of the audience's perspective and unique barriers to change; and
13. Use existing social networks to diffuse information and use effective opinion leaders.

III. Raw Data Collection

A. Water Districts

1. Alameda County Water District; 43885 South Grimmer Boulevard, Fremont, CA. 94538; (510) 659-1970; acwd@infolane.com;

2. **California Urban Water Conservation Council; 455 Capitol Mall #705, 95814; (916) 552-5885;**

3. Lisa Helm; Arizona Municipal Water Users Association; 4041 N. Central, Suite 900, Phoenix, AZ. 85012; (602) 248-8482;

4. Bob Montague, Water Conservation Coordinator for City of Virginia Beach Public Utilities, Municipal Center, Virginia Beach, VA. 23456; (757) 427-8035; bmontagu@city.virginia-beach@va.us;

5. Luis Generoso; City of San Diego Water Resources Management Program,, City of San Diego Water Utilities Department; 600 B Street, Suite 1210, San Diego, CA. 92101; (619) 533-5258;

6. California Urban Water Conservation Council, 455 Capitol Mall #705, S Sacramento, CA. 95814; (916) 552-5885;

7. Lisa LeBlanc: Greater Vancouver Regional District, 4330 Kingsway, 3rd floor, Burnaby, B.C. V5H 4G8; (604) 436-6795; http://www.gvrd.bc.ca;

B. Lodgings

1. Jim Ackles; La Quinta Inns, Inc.; 112 East Pecan Street, San Antonio, TX. (210) 302-6570; jackles@laquinta.com.

This chain of inns uses the following combination of tools:

a. They conduct a *rate and utility bill analysis* since they find overbilling errors in over 50% of their bills. They use gallons per guest as a benchmark, with 125 gallons/guest for older properties (undefined) and 95 gallons/guest for newer properties. They do very little submetering and concentrate on, in descending order, showering, laundry and irrigation.

b. *Irrigation:* They use native, adaptive plants to minimize water use and have developed an irrigation training program for staff. For their Texas properties, they installed a computerized system for drip irrigation near the sidewalks with a Texas Water Resource Board certified irrigator

c. *Sub-metering* is also conducted on a limited scale and annually they conduct tests to detect leaks. They see spikes in water use, they will then identify the problem and rectify it.

d. *Conservation and Finance-link training:* Every year, the director of engineering visits each of the chain's 19 regions and gives a briefing about conservation, preventive maintenance and how water bills affect their bonuses.

e. *Awards as incentive:* They capitalized on, and motivated their staff and managers by advertising their awards, including those given by the American Water Works Association.

f. *Building Audits:* Building audits are conducted to help develop demand-side pressures. They have adopted a linen-towel changeout program in which the guest is given the option of not having their linens and towels changed daily, and have saved money in labor.

g. *Hardware installation: Like* many hotels, they have installed water saving devices such as low flow showerheads and toilets. Mr. Ackles mentioned how important the method of installation is, noting such details as wall insulation and sound batons.

2. Lauren Broder; Inn of the Anasazi, 113 Washington Avenue, Santa Fe, New Mexico: (505) 988-3030; lbroder@confularc.com;

3. Donna Kabay and Janet Byrd; The Colony Hotel, 140 Ocean Avenue, P.O 511, Kennebunkport, Maine 04046; (207) 967-4374 and info-me@thecolonyhotel.com, or http://www.thecolonyhotel.com/maine/environment.html for further information regarding their environmental program.

This hotel has established a very sophisticated and mature sustainability program and is a leader in Maine Businesses for Social Responsibility. Specific to water use they have:

a. *Advertised and promoted* the hotel's commitment to the environment to all audiences, including the business community, guests, staff, managers and the tourist industry;
b. *Environmental bulletin board:* An environmental bulletin board is used that has a seasonal theme and on it is posted the hotel's environmental policy regarding not watering the lawns and plant beds. Native plants that require less water are used as well;
c. *Guestroom signage* is used to communicate about the towel-linen changeout program and water saving tips are posted;
d. *Energy Star™ equipment* is used that is more energy efficient and uses less water;
e. *All bathrooms have water saving tips posted;*
f. *Continuous improvement:* During the year the Ecology Group, an established group within the hotel, looks for better ways to educate staff and guests regarding the environmental policies. Each representative then in turn transmits the information to their department to discuss and implement new strategies and get feedback from staff;
g. *New Staff Orientation:* Hotel environmental policies are discussed at the beginning of each season's staff orientation;
h. *Web site:* The hotel web site contains an environmental programs section; and
i. *Information packets* sent out to inquirers (weddings, corporate, leisure, motorcoach) contain the hotel's environmental policies and a reprint of articles written about the hotel.

4. Danny O'Farrill; Don Shula's Hotel and Golf Club; Main Street, Miami Lakes, FL. 33014; (305) 821-1150;

5. Rocky Paulsen, Embassy Suites Hotel, Seattle-Tacoma International Airport; 15920 West Valley Highway, Seattle, WA. 98188-5547; (425) 228-2517. In addition to using water saving devices, the hotel has developed a "suite care-pm program" so leaks are reported to engineers. Their corporate headquarters have trained staff regarding environmental issues including water conservation. They also have developed an incentive system that financially rewards staff or managers that have noticed a situation or pattern that increases water use.

6. Mark Rugenstein; Halekulani Hotel, 2199 Kalia Road, Honolulu, Hi. 96815; (808) 923-2311; roadkingmark@worldnet.att.net. They have

educated staff regarding water use and the kitchen uses a thawing tub to replace traditional methods of continuously running water over frozen foods;

7. Greg Pushard; Harrah's Las Vegas, 3475 Las Vegas Boulevard South, Las Vegas, NV. 89109; (702) 369-5044;

8. Brent Reynolds; Holiday Inn, Boardman, Ohio; 7410 South Avenue, Boardman, Ohio 44512; (330) 726-1611; hiboard@raex.com;

9. Brian Burke; Hyatt Hotels Corporation; 200 West Madison, Chicago, IL. 60606; (312) 750-8294; bburke@corphqpo.hyatt;

10. Charles Duffner; New York Marriott Marquis; 1535 Broadway, New York, NY 10036; (212) 704-8707;

11. Eric Johnson, Norfolk Airport Hilton, 1500 North Military Highway, Norfolk, VA. 23502; (757) 466-8000;

12. Nick Feola, Ocean Edge Resort and Golf Club; 2907 Main Street, Brewster, MA. 02631; (508) 896-9000, x 1420;

13. John Rizzo; Boston Park Plaza, 64 Arlington Street, Boston, MA. 02116; (617) 457-2269;

14. Paul Hayes, Hyatt Regency at Gainey Ranch, Scottsdale, AZ.; (602) 991-3388; phayes@scottpohyatt.com;

15. Jim Sasiak, Best Western Regional offices; (310) 376-4452

16. John Limbo; ITT Sheraton Corporation, 777 Westchester Avenue, White Plains, NY 10604; (914) 640-8100;

17. Rick Bailey; Quality Inn Suites, 3817 North Pan Am Expressway, San Antonio, TX; (210) 224-3030;

18. Werner Janssen; Sleeping Lady; Icicle Road, Leavenworth, WA. (509) wjanssen@sleepinglady.com;

19. Wayne Campbell; San Diego Hilton Beach & Tennis Resort, 1775 East

Mission Bay Drive, San Diego, CA. 92109; (619) 276-4010 or waynecampbell@hilton.com. This Hilton property installed water conserving plumbing fixtures, removed the kitchen garbage disposals, installed a computer controlled irrigation system that uses local weather patterns to determine irrigation schedule and reused ice meltage for irrigation. The installation of water-conserving plumbing fixtures alone provided the hotel with over $31,000 annual water and sewer savings.

C. Academic Institutions

1. David Stipanuk; Cornell University School of Hotel Administration, Cornell University, Ithaca, NY 14853; david.stipanuk@cornell.edu. They published a study entitled "Water Resources for Lodging Operations" which is published by the Educational Institute of the AH & MA;

2. Florida Atlantic University, Florida Center for Environmental Studies; Northern Palm Beach Campus, 3970 RCA Boulevard, Palm Beach, FL. 33410; (561) 691-8554. The University does not keep this type of data although the FL.Energy Extension is an excellent contact; Pierce Jones, Director; (352) 392-5684 or ez@agen.ufl.edu;

3. Professor Sheryl Fried Kline, Widener School of Hospitality Management, One University Place, Chester, PA. 19013-5792; (610) 499-1101.Sheryl.F.Kline@widener.edu;

4. Professor Ken Teeters, University of Nevada, Tourism and Convention Department; (702) 895-4459.

D. Tourism Related Associations

1. Linzey Coles, International Hotels Environment Initiative; 1516 Cornwall Terrace, Regents Park, London NW1 4QP England, linzey.coles@pwblif.org.uk; (011) 44-171-467-3623;

2. Patty Griffin, Green Hotels Association; P.O. Box 420212, Houston, TX. 77242-0212; green@greenhotels.com; (713) 789-8889;

3. Bob Elliott; Chair of the Engineering and Environment Committee; American Hotel and Motel Association; 1201 New York Avenue NW, Suite 600, Washington, DC. 20005-3931; (202) 289-3100;

4. Dan Bornholdt; Green Suites International; 1551 West 13th Street, Suite 304, Upland, CA. 91786; (909) 920-1277; Grnsuites@aol.com;

5. Education Institute of the American Hotel and Motel Association; 2113 North High Street, Lansing, Michigan 48906; (517) 372-8800; www.ei.ahma.org and info@ei.ahma.org;

6. Scott Wayne, World Travel and Tourism Council; D.C. Business Development Office; 2527 I Street NW, Washington , DC 20037-2211; (202) 463-7394 or ScottWayne@compuserve.com;

7. Alaska Hotel and Motel Association; P.O. Box 104900, Anchorage, Alaska 99510-4900; (907) 272-1229; akhma@alaska.net.

E. Government Programs and Non-Government Organizations

1. Trudy Mason; EcoSmart Properties; (212) 430-4000 x4030;

2. Mark Tetruzzi; Green Seal; 1400 16th Street NW, Suite 300, Washington, DC. 20036-3101; (202) 872-6400;

3. John Flowers and Valerie Martin; EPA's Water Alliances for Voluntary Efficiency; EPA Office of Water (4204), 401 M Street SW, Washington, DC 20460; (202) 260-7288; martin.valerie@epa.gov;

4. Conservation International; 2501 M Street SW. Suite 200, Washington, DC 20037; (202) 429-5660; http://www.conservation.org;

5. **Responsible Tourism Institute; newtourism@newtourism.org;**

6. **Earth Council; Apartado 2323-1002, San Jose, Costa Rica; http://www.ecouncil.ac.cr (formed after Rio Summit in 1992 to promote and advance implementation of the Earth Summit agreements);**

7. **World Resource Institute; 1709 New York Avenue, Washington, DC 20036; (202) 638-6300; info@wri.org;**

8. World Tourism Organization; Capitan Haya 42; 28020, Madrid, Spain; (34) 91 567 8100; omtweb@world-tourism.org.

IV. Conclusion and Designing Successful Programs

Because the data does not represent the full complement of hotels in the United States that might be engaging in environmental practices and education, the reporting in this document is not representative. However, based on applied research in areas of environmental management, sustainability tools, organizational behavior, human behavioral change and a survey of international sustainable tourism practices, it is possible to list those attributes most likely to lead to a successful water efficiency program.

Based on the limited data available, the Colony Hotel in Kennebunkport, Maine appears to have the best comprehensive success in environmental management, although a hotel the size of the San Diego Hilton Beach & Tennis Resort that has installed water-conserving plumbing is saving over $31,000/per annum. However, determining success is based on more than the water saved in any given year. Rather, success might be measured by whether those changes are part of a long-term strategy that is integral to the hotel's philosophy and practice, versus the result of an environmental champion whose departure will impair long term environmental improvement.

Successful water efficiency programs will depend on a number of complex variables including:

1. *Organizational Commitment:* If the CEO/COO of the corporate headquarters, Board of Directors (where applicable), and General Manager of the local property are committed to environmental excellence, have a written environmental policy, and have committed valuable resources to this task, ensuing programs, whether instituted nationally or locally, stand a much better chance of success;

2. *Environmental Programs are integrated into all job functions:* Where the environmental policy is part of every individual's job responsibilities and the organization integrates environmental performance into their indicators

and performance standards, there is an effective built-in incentive to address issues such as water efficiency;

3. *Staff are asked to participate in creative innovation and decisionmaking:* A well informed, empowered staff are essential to any environmental program success;

4. *Messaging is positive:* The environmental program is cast in terms of benefit, lost opportunities and emphasizes that incremental and small measures have profound effects;

5. *Incentive systems are developed*: These can be financial, control over work, time-off, vacations, small prizes such as free nights at the hotel or meals, or public recognition;

6. *Educational tools seek to affirm existing value systems*: All educational programs should be aligned with the value system of the listeners and seek to incorporate case studies, field trips and daily experiences into the curricula;

7. *Credible, local, sources are used to convey information:* Identify trust sources in your targeted sector, ask them to help convey and tailor messages and incorporate the message into existing communication networks.

Source: Gardner, Gerald T., and Stern, Paul C., *Environmental Problems and Human Behavior,* Allyn & Bacon, Needham Heights, MA. 1996.

Appendix 2: Hotel Contact List

-June 15, 1999

Hotel Water Education Demonstration Project

Hotels and other government, NGOs and academic institutions contacted as of June 11, 1999:

3. Lisa LeBlanc: Greater Vancouver Regional District, 4330 Kingsway, 3rd floor, Burnaby, B.C. V5H 4G8; (604) 436-6795; http://www.gvrd.bc.ca Lisa is sending me the list of hotels from their May 1988 Study of water consumption and water conservation potential so I can contact them directly;

4. John Flowers and Valerie Martin; EPA's Water Alliances for Voluntary Efficiency; (202) 260-7288; martin.valerie@epa.gov. The WAVE program had many participants, almost all of which I contacted;

5. Lisa Helm; Arizona Municipal Water Users Association; 4041 N. Central, Suite 900, Phoenix, AZ. 85012 (602) 248-8482. They have not collected hotel specific data but published an excellent document entitled "Facility Manager's Guide to Water Management."

6. Linzey Coles, International Hotels Environment Initiative; linzey.coles@pwblif.org.uk; (011) 44-171-467-3623. US participation in the initiative has been negligible and they won't send hotel names specifically. You might look at a copy of the *Green Hotelier* magazine.

7. David Stipanuk; Cornell University School of Hotel Administration, Cornell University, Ithaca, NY 14853; david.stipanuk@cornell.edu.. They published a study entitled "Water Resources for Lodging Operations" which is published by the Educational Institute of the AH & MA;

8. Jim Ackles; La Quinta Inns, Inc.; 112 East Pecan Street, #200, San Antonio, TX. 78205; (210) 302-6570/jackles@laquinta.com. This hotel chain has a fully developed water conservation program.

9. Patty Griffin, Green Hotels Association; green@greenhotels.com; (713) 789-8889. She doesn't keep water conservation data but they do sell resource saving equipment, placards and tip sheets.

10. Lauren Broder; lbroder@confularc.com: Inn of the Anasazi: (505) 988-3030. Was never able to reach her.

11. Florida Atlantic University, Florida Center for Environmental Studies; Northern Palm Beach Campus, 3970 RCA Boulevard, Palm Beach, FL. 33410; (561) 691-8554. The University does not keep this type of data but the Florida Energy Extension could be quite helpful as it specializes in restaurant efficiency.

12. Conservation International; (no leads)

13. Responsible Tourism Institute; (no leads)

14. Earth Council (no leads)

15. World Resources Institute (no leads)

16. World Tourism Organization (no leads)

17. Bob Elliott; Chair of the Engineering and Environment Committee; American Hotel and Motel Association; (202) 289-3100.

18. Luis Generoso; San Diego Hilton and Tennis Resort through the City of San Diego Water Resources Management Program; (619) 533-5258; and Wayne Campbell, Director of Property Operations; waynecampbell@hilton.com . I received a write up concerning this hotel which is known for its conservation efforts but have not reached Mr. Campbell

19. Dan Bornholdt; Green Suites International; Grnsuites@aol.com

20. John Boynton; Green Suites International; (206) 781-3499. John worked for the Seattle Sheraton for many years and will be a good contact, particularly for focus groups

21. Bob Montague, Water Conservation Coordinator for City of Virginia Beach Public Utilities, Municipal Center, Virginia Beach, VA. 23456; (757) 427-8035 (no leads); bmontagu@city.virginia-beach@va.us

22. Education Institute of the American Hotel and Motel Association; www.ei.ahma.org and info@ei.ahma.org

23. Trudy Mason; EcoSmart Properties; (212) 430-4000 x4030

24. Donna Kabay; The Colony Hotel, (207) 967-3331; http://wwwthecolonyhotel.com/maine/environment.html. I received a lengthy e-mail from Donna outlining their very ambitious and broad environmental program

25. Danny O'Farrill; Don Shula's Hotel and Golf Club; Main Street, Miami Lakes, FL. 33014; (305) 821-1150.
26. Rocky Paulsen, Embassy Suites Hotel, Seattle-Tacoma International Airport; 15920 West Valley Highway, Seattle, WA. 98188-5547; (425) 228-2517

27. Mark Rugenstein; Halekulani Hotel, 2199 Kalia Road, Honolulu, Hi. 96815; (808) 923-2311; roadkingmark@worldnet.att.net.

28. Greg Pushard; Harrah's Las Vegas, 3475 Las Vegas Boulevard South, Las Vegas, NV. 89109; (702) 369-5044

29. Brent Reynolds; Holiday Inn, Boardman, Ohio; 7410 South Avenue, Boardman, Ohio 44512; (330) 726-1611; .hiboard@raex.com.

30. Brian Burke; Hyatt Hotels Corporation; 200 West Madison, Chicago, IL. 60606; (312) 750-8294; bburke@corphqpo.hyatt

31. Charles Duffner; New York Marriott Marquis; 1535 Broadway, New York, NY 10036; (212) 704-8707

32. Eric Johnson, Norfolk Airport Hilton, 1500 North Military Highway, Norfolk, VA. 23502; (757) 466-8000

33. Nick Feola, Ocean Edge Resort and Golf Club; 2907 Main Street, Brewster, MA. 02631; (508) 896-9000, x 1420

34. John Rizzo; Boston Park Plaza, 64 Arlington Street, Boston, MA. 02116; (617) 457-2269
35. Professor Sheryl Fried Kline, Widener School of Hospitality Management, One University Place, Chester, PA. 19013-5792; (610) 499-1101

36. Paul Hayes, Hyatt Regency at Gainey Ranch, Scottsdale, AZ.; (602) 991-3388; phayes@scottpohyatt.com

37. California Urban Water Conservation Council, 455 Capitol Mall #705, S Sacramento, CA. 95814; (916) 552-5885

38. Scott Wayne, World Travel and Tourism Council; (202) 463-7394. Scott referred me to the Green Globe sustainable tourism program

39. Mark Tetruzzi; Green Seal; (202) 872-6400. In conjunction with Green Globe, they have adopted lodging standards

40. Professor Ken Teeters, University of Nevada, Tourism and Convention Department; (702) 895-4459

41. Jim Sasiak, Best Western Regional offices; (310) 376-4452.

42. John Lembo; Starwood Hotels and Resorts Worldwide, 777 Westchester Avenue, White Plains, NY 10604; (914) 640-8100

43. Rick Bailey; Quality Inn Suites, San Antonio, TX; (210) 224-3030

44. Alaska Hotel and Motel Association; P.O. Box 104900, Anchorage, Alaska 99510-4900; (907) 272-1229; akhma@alaska.net

45. Werner Janssen; Sleeping Lady; wjanssen@sleepinglady.com.

Appendix 3: Phone Survey Results

Results of Telephone Survey Instrument:
Seattle Hotels and Water Conservation Measures

Hotel Demonstration Project

September 1999
Prepared for: Seattle Public Utilities, Conservation Program
By Heidi Siegelbaum, O'Neill & Siegelbaum, Seattle, WA.
Contract DC 99022; Property of Seattle Public Utilities

Background

Between August 17th and September 23rd, 1999, over 60 Seattle hotels were contacted with respect to the Hotel Demonstration Project. This project title refers to the combined efforts of Seattle Public Utility's (SPU's) Resource Conservation Section and several consultants specializing in mechanical engineering and sustainable tourism, respectively. This group constitutes the project team.

Out of the hotels surveyed, 20 responded to the questionnaire designed to collect baseline raw data concerning the use of water conservation measures. The hotels were classified into four (4) categories based on room size. All hotels with 74 rooms and under were excluded from the survey instrument process, as SPU wanted to focus on larger hotels to maximize its effectiveness and reach into this commercial sector.

The sample field chosen represents all hotels known in Seattle which have 75 rooms and over. The surveyed hotels in the sample represent 40% of the selected field and 25% of all Seattle hotels, the latter of which includes all Seattle hotels regardless of room size.

Interviews with hotel engineers were taken in the following hotels:

A. 75-149 rooms: *

Alexis Hotel: Mike Devine, Engineer: 624-4844
Best Western Executive Inn: George Tomosvari, Engineer: 448-9444
Days Inn Town Center: John Oravitz, Maintenance Engineer: 448-3434
Hotel Seattle: Joel Neyhart, Engineer: 623-5110
Paramount Hotel: Bob Bolstead, Engineer: 292-9500
Starwood's Edmond Meany Hotel: Erik Bodeau, Engineer: 634-2000
Travelodge by the Space Needle: Chris Tudor, General Manager: 441-7878
University Inn: Mike Doyle, Engineer: 632-5055

* 39% of the hotels in this room size category

B. 150-299 rooms: *

Edgewater Hotel: Lloyd Van Horn, Engineer: 728-7000
Courtyard Lake Union by Marriott: Henriques Ramson, Engineer: 213-0100
Ramada Inn at Northgate: Chris Adams, Maintenance Engineer: 365-0700
Roosevelt Hotel: Frank Arnold, Engineer: 621-1200
Seattle Inn: Tim Chiles, Engineer: 728-7666
Starwood's Sixth Avenue Inn: John Oravitz, Engineer: 441-8300
Warwick Hotel: Scott Anderson, Engineer: 443-4300

* 40% of the hotels in this room size category

C. 300 rooms and over: *

Crowne Plaza Hotel Seattle: Bob Johansen, Engineer: 464-1980
Four Seasons Olympic Hotel: Steve Robinson, Engineer (Bruce Jarrad, Chief Engineer): 621-1700
Stouffer's Madison Hotel: Larry Robins, Engineer: 583-0300
Sheraton Seattle Hotel & Towers: Scott Marshall, Engineer: 621-9000
Westin Hotel: Rodney Schauf, Engineer: 728-1000

* 83% of the hotels in this room size category

Findings

C. Measures Adopted

An overwhelming majority of the hotels surveyed had installed some combination of water conserving measures in the last five (5) years, including six, or 31%, that had adopted the well known towel-linen program in which guests are given the option of not having their towels and linens laundered daily. 90% of the hotels had installed faucet aerators and low flow showerheads, while only 50% had installed low flow toilets. Many of the hotels reported complaints from guests or internal dissatisfaction with the toilet and showerhead performance. Only 35% of the surveyed hotels had installed low flow urinals in public restrooms although 65% had installed faucet aerators in this part of the hotel. Air-cooled ice machines were used in 60% of the surveyed hotels although only 5% had what they considered to be efficient commercial dishwashers.

25%, or five (5) hotels, had adopted gray water reclamation or wash and rinse reuse systems (in which the water from the last rinse cycle is stored, filtered and then re-used in a subsequent wash cycle for first rinse). The same percentage of hotels also used what they considered to be high-efficiency commercial dishwashers. These hotels did not necessarily adopt both measures, but either one or the other.

A very small number had adopted or had knowledge of using thawing policies in which frozen foods are thawed in a walk-in refrigerator rather than continuously running water over the food to thaw. This could have significant implications for those hotels serving over 1 million meals a year (large convention and banquet operations).

D. Knowledge of, and measuring water conservation potential

An overwhelming number of the hotel staff and managers were not trained specifically in conservation techniques and measures, and 90% did not know or did not have access, to cost saving data correlating to the water conservation measures already adopted. Related to this finding, none of the surveyed hotels knew, by department or function, how much water was being used and 55% did not have submeters or deduct meters in the hotel.

C. Ownership and culture

Most the surveyed hotels, or 85%, are part of larger holding companies, real estate investment trusts (REITs), joint ventures, corporate affiliates, or franchises. The trend in many of these companies, including Starwood Hotels & Resorts Worldwide, Inc. (Starwood), Host-Marriott Corporation and the Kimpton Group, is to purchase existing structures and renovate them rather than starting new construction projects. Accordingly, there may be more serious barriers to installing efficient water conserving measures due to the age, original condition or use of the building.

In addition, many of these hotels are publicly traded so there is considerable pressure to provide an attractive return on investment. Most of the hotel's parent corporations clearly state that their primary business objective is to acquire high quality assets with potential for significant capital appreciation, and to maximize earnings and cash flow. The challenge is to educate the hotels regarding the value of natural capital and the financial and environmental benefits of conservation and efficiency, thereby leading to increases in net operating profits.

Only 26% of the surveyed hotels believed that their parent corporations or joint ventures had a written environmental policy or action plan, although several stated that conservation was integral to their property's overall goals. Several of these companies, notably Hilton, Marriott and Starwood, belong to the International Hotels Environmental Initiative (IHEI) with offices in London, so they already have an environmental policy or presence in overseas operations. Whether these policies "trickle down" to domestic operations and policies is unclear.

When asked how certain factors or conditions rated when considering whether to adopt water conservation measures, the overwhelming majority were motivated by knowing their action are important to the community. 75% acknowledged the inherent value in water as well as the limitations imposed by municipal water storage capacity. Less than half (45%) believed the trend towards "green tourism" or value-based purchasing was important in making water conservation decisions, and 70% were motivated by utility rebates.

E. Financial Decision Making

50% of the engineers surveyed were not familiar with the hotel's investment criteria but 90% of the remaining sample used a payback period between 1 and 3 years, with three using 2-2.5 year payback, three using 1-year payback, and one each using 3 and 7-8 year payback periods. Capital limits were reported as variable depending on where the investment fit into priority based budgeting, available funds, competing interests, occupancy rates and other exigencies. Several reported having unlimited capital funds for water conservation projects but an equal number reported having to get parent corporate approval for capital improvements of any dollar amount.

When reported, capital budgets ranged from $500 to over $20,000, while several chose to maintain confidentiality regarding such figures. 50% of the surveyed hotels reported having

funds available to adopt water conservation measures and 60% had space and willingness to beta-test equipment in one or more of their rooms.

D. Recommendations

A majority of the surveyed hotels were generally familiar with water conservation measures, but were unable to more particularly characterize water use within each department or function, or to measure cost savings associated with such measures. Since most of the surveyed engineers had not received specific water conservation training, their hotels would benefit from receiving more specific information regarding available technology and performance parameters, distributors and cost savings associated with each conservation measure. In particular, these hotels need more submeters or deduct meters to identify areas of greater water use, and to use software and other tools designed to measure cost savings. These in turn can be used to more accurately forecast, budget and set priorities for other capital investments, and possibly lead to using longer payback periods.

Appendix 5: Drivers of Sustainable Tourism

March 16, 2000

What is driving sustainable tourism and travel?

Prepared for Seattle Public Utilities by:

Heidi Siegelbaum
O'Neill & Siegelbaum
(206) 784-4265
wastenot@speakeasy.org

WHAT is sustainable tourism and travel?

- Planning, development and activities, including purchased products, that will ensure future generations they can meet their own needs
- Requires long term planning and defining a vision
- Involves every person in an organization
- Extends to every facet of the tourism industry, including hotels

WHY involve tourism and travel sectors in sustainability?

- The sector is represented everywhere: lodging, food, recreation, national parks, culture, natural areas, interpreters, retail, transportation, banking and insurance
- It is universally connected to the physical and cultural environment
- Growth patterns are creating pressure on sensitive areas
- Balanced planning ensures long term economic stability and healthy communities
- Growing public demand for accountable, responsible business practices
- Can promote best practices and loyal customer base

WHAT drives environmental sustainability?

- Enhanced public perception
- Customer appeal in that they can reward those businesses providing environmentally preferable services
- Avoids regulatory pressure if adopted voluntarily
- Individual control over local use of resources
- Economic incentives: green is lean and clean
- Diversifies tourism experience by meeting demand for greater educational experiences
- Public pressure and growing market demand, particularly in the NW
- Lack of interest in touring "devastated landscapes"
- Soul of business and its staff say it's the "right thing to do"

RESPONDING to questions about the towel-linen program (sound bites)

- The program is voluntary; you may choose to launder your towels and linens daily if you wish
- We believe that environmental management, of which this program is an important first step, is consistent with changing views of corporate responsibility
- There are many competing uses for water locally and the hotel wants to do its part in responding to the issues raised by the Salmon ESA (Endangered Species Act) listing

- Despite the amount of rainfall we may receive in winter months, there is no such thing as "new water." Hence, in order to ensure there is adequate water for all competing uses, we believe this voluntary towel-linen program is a remarkably effective tool for being a good community actor
- The local environment is the centerpiece of what draws visitors to Seattle and Washington State. Water efficiency/conservation is part of our way of expressing our commitment to this community and to ensure we protect it for everyone's children and grandchildren
- We are proud to work for a hotel that is starting to evaluate its impact on the environment and adopt programs to address environmental conservation

PROCESS ensures success

- Distribute the SPU fact sheet to everyone on staff or ensure they see it through a distribution circuit (or post it on-line)
- Ensure your sales and marketing representatives have a copy and understand the program's basis- use this program to market the hotel and find new ways to increase your environmental performance (e.g.; packaging reduction, toxic use reduction, organics management, lighting/equipment efficiency)
- Include bell service, concierge and off-site reservationists in this effort
- Read about water conservation locally by calling SPU at 684-7560 or 684-7600 or see www.ci.seattle.wa.us/util/spumain.htm.
- Learn about local salmon challenges at 1-877-Salmon 9 or www.salmoninfo.org
- Urge your corporate offices to adopt a long-term environmental strategy and start to address sustainable travel and tourism

ORIENTATION

Water, the Westin and YOU, you Water Smart person!

Uwe ka lani ola ka honna

[When the heavens weep, the earth lives]

This document was prepared in connection with a Hotel Water Demonstration Project, managed by Seattle Public Utilities (SPU), that was conducted from April 1999 through March 2001.

The pilot project was designed to increase water efficiency and conservation opportunities for the hotel industry, leading to cost savings, improved water quantity and quality, added value to staff and guests, thereby reflecting Washington's conservation and community values.

Further information? Philip Paschke, Resource Conservation Section, Community Services Division, 710 Second Avenue, 5th floor, Seattle, WA. 98104
(206) 684-5883 or 684-SAVE
phil.paschke@ci.seattle.wa.us
URL: http://www.ci.seattle.wa.us/util/rescons

I. The Mystical Qualities of Water

"Water is silky, dense, and poetic stuff. It's cohesive, yet it parts under pressure, eluding touch. On a recent trip to hot springs on the Peninsula, I had the opportunity to think about this. The delicate, sulphorous mist hanging above the pools was a substance that fit no category: Almost liquid, yet airborne, it was inhalable in its thousands of little microdots. The delicate mist's layers captured light and fell into diving currents, pulled by wind. Water is an indelible, continuous link between plants, animals, and everything alive; this taut configuration seems at once startling as a dream and astonishingly real. At the same time, water is a frank necessity."

[Stacey Levine; "Watered Down," August 3, 2000. Reprinted with permission from the Seattle Weekly]

Water is amazing stuff. It can break boulders the size of cars, has more dimensions that any other substance, allows nutrients to pass through organ membranes in our bodies, and sustains everything that is alive. No water? Nothing lives.

Us? 70% water. Ice cream? 88%. Your cat? 62%, The family dog 63%.[1]

When you put water in context, you look at its practical value, sometimes overlooked, and may once again create wonder in your perspective. Why do we pay so much more money to live with a view of the water?

II. Protecting What We Love and Need

In 1854, London suffered a cholera epidemic that killed thousands of people when the bacteria, *vibrio cholerae bacterium,* traveled from India to London when a ship dumped contaminated water into the Thames River—the city's water source. From this outbreak was born water treatment systems and protection of water as a drinking water source. In developing countries throughout the world, only 35% of the population has access to clean water and cholera epidemics continue in 2001. [2] Many postulate that future wars will be waged over water availability.

In Washington State, or more specifically, in Seattle and its surrounding areas (places North to Edmonds and Woodinville, East to Bellevue, Duvall, and Kirkland, south to Auburn, Federal Way, Renton and Tukwila), SPU and its partner utilities (called "purveyors") protect public drinking water supplies by prohibiting commercial activities from taking place in these watersheds and ensuring they are protected from access by anyone except utility folks. The Cedar River and Tolt *watersheds,* the land area draining into these rivers, are our collective source for drinking water. **These two sources alone provide 150 million gallons a day to the over 1 million people living and working in Seattle and surrounding cities.** Big water for a big utility!

The road to you…or where your water comes from…

Rain and snow falls in the Cascade Mountains, flowing into mountain reservoirs and rivers, where it goes through a circular pattern from sky to land, back to sky again. This is the ancient water cycle that essentially recirculates the same water from the millennium. The water falling on your back probably fell on a black bear in 1652, meaning that there is no such thing as "new" water- another reason to protect it from waste. It's historical!

After it's collected, the water is screened, then fluoride, lime, soda ash (Tolt only) and chlorine are added. It is then sent to finished reservoirs and split into several pipelines—one to the commercial/industrial sector and the other to residents.

The road from you… or where your water goes…

When water is flushed in a toilet, or goes down a drain inside a building, it is going into the sanitary sewer system where it travels to Renton or the West Point Treatment Center. At these locations, the wastewater goes through primary treatment—screening, settling and disinfection—followed by secondary treatment which removes most, but not all, solids, toxic chemicals, metals and biological oxygen demand. It is then discharged into open water or used for fuel or as farm soil amendments.

III. Can we please have more water?

In 1996, the Seattle City Council asked SPU to complete a *Water Conservation Potential Assessment (CPPA)* to review conservation potential. Up to 31 million gallons per day (mgd), or 16% of the water used between June and August, can be conserved within the next 20 years with no reduction in customer's ability to use water and with satisfaction with services. It is difficult, if not highly unlikely, that SPU can develop new water sources outside existing ones due to geographical, political or financial limitations. Beyond 2013, based on current projections, water demand will exceed supply and conservation initiatives will be mandatory rather than voluntary. [3]

Rain does not mean drinking water!! In fact, if you put the world's water in a pitcher, only a tablespoon would be available for human use (.05%).

Not just us…. The area's water supply is also a shared resource: it is used for irrigation of crops and landscaping, wildlife habitat and consumption, cleaning up at home, cooking, farming, industrial sources, and salmon. No water, no salmon spawning. The Cedar Habitat Conservation Plan (HCP) commits to releasing [x] millions of gallons in the fall to facilitate salmon migration and is part of the region's growing problem with declines in salmon population .[4]

Under the City's proposal, fish habitat and water supply planning would be more certain and would provide instream flows (water to swim) for Chinook, sockeye and coho salmon, as well as steelhead trout.

In addition to balancing competing interests for water and making sure everyone has what they need, SPU recently announced its **1% for Water Conservation Program- go team go! The 1% water conservation program** is a recently adopted SPU program in which the City is challenging its citizens and businesses to conserve 1% each year, over 10 years, of the water it's currently using.

ARE YOU GAME? The challenge is equivalent to using one gallon less per person every day. You already use about 78 gallons per day. Just you.

What is this thing we call the challenge? Call 684-SAVE (684-7283) or see http://ci.seattle.wa.us/util/onepercent/default.htm

IV. Being Water Smart at the Hotel

You can think of water conservation or efficiency (the same thing) like a savings account: you save now so you are safe later when you really need it (shortages, drought, natural disasters like earthquakes).

Why be water smart?

- Save on water bills! Those savings can be used for different purposes
- Postpone rate increases
- Improve water reliability and quality
- Meet the needs of your kids and grandkids and other people you love
- Ensure habitats for animals and ecosystems are maintained
- Protect drinking water
- Reduce pollution: less water used means less hot water heating (energy means natural resource use; not just hydropower, but coal and oil burning which is a very dirty process) and less water going to the wastewater treatment plants
- *Your guests are paying attention!* The City receives letters at the Mayor's office and SPU expressing concern that hotels are using too much water
- It's a basic part of greening your hotel, a worldwide trend which the US is slowly catching up with
- You can't live without it!
- We drink it, are mesmerized by it, play in it, are entranced by its forms

Dimensions of the water bill at the hotel:

- *Water, just water*
- *Sewer charges for treatment*
- *Heating*
- *Taxes*
- *The language of water: Water bills are expressed in cubic feet of water or* ***ccf,*** *which equals 748 gallons*
- *One gallon of water weights 8.34 lbs*
- *For national reporting, millions of gallons per day are used (Mgal/d). This is the same as having a pool the length of a football field, 50 feet wide and 10 feet deep.*

Average water use per hotel room:

Over 500 rooms: 164-254 gallons/day or, over 92,000 gallons/year for a 500-room hotel
Deluxe hotel: 232 gallons/day on average

Other averages:

1. *Toilets:* **The good**… 4 flushes/day using a 1.6 gallon per flush (gpf) toilet=6.4 gallons/day/per person/per room
   The bad… 4 flushes/day using a 3.5 gpf toilet= 14 gallons/day/per person/per room
   And the ugly… the wrong low flow toilet for the hotel

Toilet Mania or "give pee a chance": Don't give up on the idea of low-flow toilets because earlier technology didn't work as well as expected. Earlier models from the mid 80s were poorly designed or installed. A good flapper will list as long as five years- a cheaper one may wear out in 6 months.

2. *Laundry:* 12 lbs/room
3. *Showers:* Up to 3.5 gallons/minute; shower length may be 10 minutes=35 gallons/shower
4. *Sink or wash basin:* 1.5 gallons/minute flow; 3 minutes/per person/day= 4.5 gallons/per person/day

1. **Front of the house:**

   - If you shave or brush your teeth at work, turn off the faucet while you work away. **Wasted shaving water=a person's drinking water for one week!**
   - If you see a leak, tighten the faucet and if you can't fix it call engineering at x5782

2. **Housekeeping and Laundry:**

- If you shave or brush your teeth at work, turn off the faucet while you work away**. Wasted shaving water=a person's drinking water for one week!**
- If you see a leak, tighten the faucet and if you can't fix it, call engineering at x5782
- Don't leave water running while you are cleaning
- Don't flush the toilet before it is cleaned
- Be careful not to drop linens on the floor to avoid double washing
- Work with engineering to test toilets and showers for leaks
- Make sure that towels and linens are not washed if the guest is participating in the towel linen program. Ask Donna Stemme and Angelica Ramsey about this great program
- Keep entry mats and doorways very clean: you can prevent a lot of carpet shampooing by stopping dirt at the door

3. Food and Beverage:

- If you shave or brush your teeth at work, turn off the faucet while you work away. **Wasted shaving water=a person's drinking water for one week!**
- If you see a leak, tighten the faucet and if you can't fix it, call engineering at x5782
- Shut off recirculating water for beverage islands
- Wash only full loads of dishes unless you need the item right away; if you do need it right away, consider handwashing that one item instead of turning the machine on
- Don't thaw food under running water! Prepare in advance and thaw in the walk-in refrigerator! You also make the refrigerator work less hard when you thaw this way! Food will also not become supersaturated with water
- Wash vegetables in sinks or tubs and not under running water (F&B uses over 136,000 gallons/year just to prepare food)
- Rinse sushi rice in a colander and not in deep tubs
- Discuss with engineering whether steam table water might be put to some good second use, rather than putting it down the drain
- When you are serving water, don't kill the guest with water and don't fill their glass just before they are getting their check. Ice production alone uses astounding amounts of water! **Ice machines in the hotel use almost 2 million gallons/year**
- If coffee of tea is served in a press, make sure the water level is correct for the number of people being served. Don't fill up a huge press for one person who wants one cup of coffee
- If you are making espresso, don't let circulating water run all day to rinse one spoon

4. Engineering and Maintenance

- If you shave or brush your teeth at work, turn off the faucet as you work away. **Wasted shaving water=a person's drinking water for one week!**
- If you see a leak of any kind, fix it immediately or report it to engineering at x5782
- Sweep if possible, don't power wash. Besides, sweeping will make you strong!
- Keep in touch with the company's energy and water efficiency programs and remember that SPU is there with great ideas to save water; call 684-SAVE
- When you have water saving ideas or read something about a new water saving technology, share it with Rod Schauf; x 5782 or raise it at a staff or manager's meeting

V. The Big Picture of Sustainable Tourism

Tourism, Washington State's fourth largest industry, creates jobs, revenue and generally contributes to the lovely quality of life here. However, like all people and industries, tourism is not without its negative impacts. 40% of all the world's natural resources are used in what is called the "built environment," those structures made by people. The hotel is one such structure and typically uses what an average of 100 households would use.

Impacts include:

- **Materials use**: primary impacts come from transportation like getting to the hotel, driving around, van pick-ups, energy (which uses water, coal, oil and sometimes nuclear sources) and virtually everything the hotel buys. Every thing you see- the napkins, linens, doilies, bar napkins, to-go coffee cups, banquet tables, wall covering-- represents a very complex and very polluting process – **its life cycle-** and by choosing products with the same quality but with less toxic materials, metals, disposable parts and so on (part of green purchasing), you can really reduce your impact. Vote with your wallet at home too.
- **Energy**: HVAC, all the equipment in the hotel from chillers to compressors, motors, fans, and cooling towers, to TVs, espresso and vending machines, have to be powered from some source, and that source, outside the Pacific NW, has been dirty power. This power choice causes acid rain and climate change (disappointed in this year's ski season?). Even here, we are almost maxed out on hydroelectric power (which carries its own plagues like chopped up salmon and decreased in-stream flows) that means we will have to make difficult choices for regional power needs.
- **Water**: Water is used like mad in hotels, from power washing, pool/spa drainage, ice machines and serving large amounts of ice water, guest rooms, cleaning and cooling towers**. Look for the Final SPU report and recommendations about the Westin. Comments? Contact the person on the front of this document.**
- **Transport:** Air travel, railcars, cruise ships, driving and 2-stroke engines used for recreation (jet skis, snowmobiles) all create tremendous air pollution not to mention the embedded and other energy used to construct the vehicle, ship, railcar.
- **Solid Waste:** There is no doubt that we are amongst the biggest hogs on earth, generating over 7 pounds of garbage/per person/per day, when much of this could

be reused, recycled or perhaps not used at all. In a hotel, guests may feel entitled to even ramp up their consumption, generating up to 28 pounds of waste/per room/per day. What is it? Shopping bags, coffee cups, paper, take out food waste and so on. The good thing is that the Westin has in-room recycling. Make sure your guests know what you are up to.

So, what is sustainable tourism and travel?

- Planning, development and activities, including purchased products, that will ensure future generations they can meet their own needs
- Requires long term planning and support from the corporate offices
- Involves every single person in the organization, including you
- Extends to every facet of the tourism industry, including hotels

Why involve tourism and travel in sustainability?

- The sector is represented everywhere: lodging, food, recreation, national parks, cultural attractions, natural areas, transportation, retail, banking and insurance
- It is universally connected to the physical and cultural environment
- Growth patterns are creating pressure on sensitive areas
- Balanced planning ensures long term economic stability and healthy communities
- Growing public demand for accountable, responsible business practices
- Can promote best practices and loyal customer base

What drives environmental sustainability?

- Enhanced public perception
- Customer appeal in that they can reward those businesses providing environmentally preferable services
- Avoids regulatory pressure if adopted voluntarily
- Individual control over local use of resources
- Economic incentives: Green is always lean, clean and less expensive!
- Diversifies tourism experience by meeting demand for greater educational experiences
- Lack of interest in touring "devastated landscapes"
- Soul of business and staff say it's the right thing to do
- Do good by doing well

VI. Ouch! My brain hurts!

For more information, see the following:

1. **Seattle Public Utilities (SPU), your friendly sponsor of this fabulous document:** Resource Conservation Section, 710 Second Avenue, Seattle, WA. 98104; 684-7283 or http://www.ci.seattle.wa.us/util/rescons
2. **SPU 1% water conservation program:** (206) 684-SAVE (7283) or http://www.ci.seattle.wa.us/util/onepercent/default.htm
3. **Water glossary:** http://water%20glossary/glossary%2096-water.html
4. **SPU's Natural Lawn care program:** (888) 860-LAWN (5296)
5. **Home and garden hints for Healthy Streams and Salmon:** http://www.metrokc.gov/exex/esa/hometips.htm
6. **Urban Creeks Legacy volunteer program:** (206) 684-7655 (covers Pipers Creek, Longfellow Creek, Taylor Creek and Thornton Creek)
7. **King County Volunteer calendar, "the Dirt."** http://dnr.metrokc.gov/wlr/p:/calendar.htm
8. **Salmon Information Center:** A searchable salmon events calendar: www://salmoninfo.org/scripts/eventsearch.asp
9. **US Geological Survey (facts and quizzes):** http://ga.water.usgs.gov/edu/wateruse.html
10. **Puget Sound Water Quality Action Team:** (800) 54-SOUND (76863) or http://www.wa.gov/puget_sound
11. **Safe Drinking Water Hotline:** (800) 521-0327
12. **Environmental Protection Agency Public Information Center:** (206) 553-4983 or 1200 Sixth Avenue, Seattle 98101
13. **To report water contamination:** (206) 684-1231
14. **Department of Ecology Hotline for recycling and hazardous waste issues:** 1-800-Recycle
15. **International Hotels Environment Initiative:** ihei@pwblf.org.uk; or http://www.oneworld.org/pwblf/ (Prince of Wales Business Leaders Forum is the umbrella organization- hence, pwblf) or www.ihei.org
16. **Toronto Green Tourism Association:** (416) 338-5084 or http://www.greentourism.on.ca
17. **Green Hotels Association:** (713) 789-8889 or http://www.greenhotels.com
18. **Green Business Network:** http://www.greenbiz.com
19. **TravelMole:** http://www.travelmole.com/item/21063/101
20. **Coalition for Environmentally Responsible Economies:** (617) 247-0700 or http://www.ceres.org
21. **Sustainable Tourism Roundtable:** US Environmental Protection Agency, The George Washington University, and the World Travel & Tourism Council: (202) 994-8197
22. **West Point Treatment Center:** For tours call (206) 296-8286 (Tuesday-Thursday for groups) and http://dnr.metrokc.gov/wtd/. Personal tours are also given through the Discovery Park Visitor Center: (206) 386-4236
23. **U.S. Geological Survey in Washington: (253) 428-3600, x2604; http://wa.water.usgs.gov/otherdata.html**

Prepared by: Heidi Siegelbaum, O'Neill & Siegelbaum; Seattle, Washington

Appendix 8: Guest Environmental Letter and Survey

26 November, 2003

Dear «Title» «LastName»

I trust your stay so far has been comfortable and enjoyable - hopefully in part because of the openable windows, 'breathe easy' paints and natural fabrics used in your room.

We've made a serious commitment to care for the environment. We need you to tell us if we are succeeding in meeting your expectations and needs for comfort, and care for the environment.

Please take 5 minutes to complete the enclosed questionnaire and give to your reception staff. By way of thanks for your time we would like to offer you a complimentary beverage* in Arena Wine Bar.

Thank you again for your time.

Yours sincerely

Gabrielle van Willigen
Environmental Manager

* One voucher per room redeemable for soft drink, beer or wine

1. Please indicate which group you belong to (*please tick*):-

(a) Age ☐ Under 16 ☐ 16 – 25
☐ 26 – 35 ☐ 36 – 45
☐ 46 – 55 ☐ 56 – 65
☐ 66 – 75 ☐ Over 75

(b) Gender ☐ Male ☐ Female

2. The main reason for your stay with us (*please tick one*)

| | Holiday

| | Business

| | Other _____

3. Do you live in Australia?
Yes / No (please circle one) If no, which country? _____

4. What was the main reason for choosing to stay with us?

| | Corporate decision

| | Price

| | Location

| | Other _____

5. How concerned are you about the environment?

| | Very

| | Moderately

| | Not at all

6. With the current issues facing our environment, how concerned are you for your children or future generations?

| | Very

| | Moderately

| | Not at all

7. Would you prefer more to stay at an environmentally friendly hotel than one which was doing little or nothing to care for the environment?

| | Yes

| | No

| | Makes no difference to me

8. a) Did you read the Hotel's green environmental booklet placed in your room?

| | Yes | | No

b) Did you find it informative? Y / N

9. a) Were you aware that this hotel donates $1.00 to the World Wide Fund For Nature (WWF) for every room sold?

| | Yes | | No

b) Do you think this is a worthwhile initiative?

| | Yes | | No
(please explain) _____
_____

10. Which of the following environmental initiatives did you utilise while staying in this hotel?

| | Organic food (eg. Free-range eggs) on the menu

| | Recycling bin in your room for glass, paper, plastic and cans

(*Please turn over*)

Q.10 Cont'd

| | Soap and shampoo dispensers instead of plastic bottles

| | Reusing bath towels

| | Openable windows

| | Indicating bed sheets need not be changed (using green postcard provided)

11. Do you care for the environment at home |h| or at work |w|? If so, please indicate which ones

| | Solar power

| | Use cloth shopping bags

| | Recycling

| | Re use plastic bags

| | Use products with less packaging

| | Composting

| | Other _____

12. What other initiatives would you suggest for guests to participate in, to assist us in efforts to care for the environment? (For example, dry cleaning returned without plastic covering.)

_____

_____

_____

13. Did any of the above initiatives positively *or* negatively affect the quality of your stay? Please explain.

_____

_____

_____

_____

Thank you for helping us care. We look forward to seeing you again soon.

The Green Team

Environment Questionnaire

How much do you care?

Your feedback is essential to further develop the environmental programme of this and future Accor hotels. Please help by answering this questionnaire and returning it to Reception.

Appendix 9: Chemical Use Inventory

The following inventory was collected at the time the project was active. It is possible that either hotel has changed their inventory since the time the data was collected.

Definitions:

CAS is the Chemical Abstracts Service that assigns identifying numbers to discrete chemical substances. Chemicals having CAS numbers are easier to search in toxicological databases.

City of Seattle Criteria for Janitorial Products: The City of Seattle, in conjunction with its emerging Environmental Management Policy, has adopted criteria by which it will purchase and use janitorial cleaning chemicals. "Basis for failure" at the top of the pages below means the chemical would fail the criteria adopted by the City.

See: ***http://www.ci.seattle.wa.us/seattle/oem/greenpurchasing/envcritjanitorialservices.doc***

EDTA is ethylene diamine tetraacetic acid and it is a chelating agent, which means it attracts heavy metals that adsorb to soils and sediments. Heavy metals are injurious to human health and their presence in wastewater poses formidable problems for operators, hence raising your sewer charges**.**

SARA 313 is part of the Comprehensive Environmental Response, Compensation and Liability Act and is intended to help communities plan for emergency response where chemicals are manufactured, stored and used. Many of the SARA listed chemicals are corrosive, flammable and have certain characteristi/cs scientists have deemed potentially dangerous for humans and the environment. See 40 Code of Federal Regulations, Part 355.

Chemical	Use	CAS*	Basis for failure
Sod. Hypochlorite	Laundry	7681-52-9	
Sod. Hydroxide	Laundry	1310-73-2	
RustGo/	Laundry		- corrosive
Hydrofluoric acid		7664-39-3	- SARA
Ammonium Bifluroide		1341-49-7	
PermaGo	Laundry		
2-2 butoxy ethoxy ethanol		112-34-5	
2-2 Propoxyethoxy ethanol		6881-94-3	
Alkylbenzene		70693-06-0	
2 butoxy ethanol		111-76-2	
TarGo	Laundry		
d-Limonene		5989-27-5	
sod. Alkyl diphenoxide		36445-71-3	
surfactant		70146-13-3	
TarGo DryCleaning	Laundry		
Ethanol 2 (2-butoxy ethoxy)		112-34-5	
Methyl Isoamyl Ketone		110-12-3	
TCE		79-01-06	- SARA, carcinogen
Nonylphenol ethoxylate		9016-45-9	- APE
Ethoxyl Ethanol		110-80-5	
YellowGo	Laundry		- corrosive
Titanous sulfate		13130-44-4	
Sulfuric acid		7664-93-9	
Citric Acid		7732-18-5	
Ammonium Bifluroide		1341-49-7	
VitalSize	Laundry		
Tetrachloroethylene		127-18-4	- SARA, carcinogen
-			
Liquid Insure (Ecolab)	Laundry		- corrosive
Hydrogen Peroxide 7722-84-1			
-			
Konite (Ecolab)	Laundry		- corrosive
Sod Hydroxide		1310-73-2	

Chemical	Use	CAS*	Basis for failure
Alert (Ecolab)	Laundry		- corrosive
Sod Carbonate		497-19-8	
Sod. Metasilicate		6834-92-0	
Nonylphenol ethoxylate		9016-45-9	- APE
Rejuvate (Ecolab)	Laundry		
Sod Percarbonate		15630-89-4	
Sod Phosphate		7758-29-4	- phosphate
Sod Carbonate		497-19-8	
Exec 120 (Ecolab)	Laundry		- corrosive
Sod.Carbonate		497-19-8	
Sod. Metasilicate		6834-92-0	
Sod. Perborate		4/4/7632	
Tri-Liqui Sour (Ecolab)	Laundry		
Hydrofluosilicic Acid		16961-83-4	
Turbocharge (Ecolab)	Laundry		- corrosive
Sod. Hydroxide		1310-73-2	
Ethylenediamine		64-02-8	
Tetraacetic acid, tetrasodium salt		- EDTA	
Triethanolamine		102-71-6	
Turbolifter (Ecolab)	Laundry		
Nonylphenol ethoxylate		9016-45-9	- APE
Butoxyethanol		111-76-2	
Builder 300 (Ecolab)	Laundry		- corrosive
Sod.Hydroxide		1310-73-2	
Karagami Waxkleen	Laundry		
Faultless Starbright Powder	Laundry		
Faultless Regular Spray Starch	Laundry		
Butane		106-97-8	
Propane		74-98-6	
Isobutane		75-28-5	
-			
Perchloroethylene	Laundry		
Tetrachloroethylene		127-18-4	- SARA, carcinogen

Chemical	Use	CAS*	Basis for failure
Ecolab Dacotex Dual Spotter	Laundry		
Nonylphenol Ethoxylate		9016-45-9	- APE
Ecolab Erustacator	Laundry		- corrosive?
Hydrofluoric Acid			
Ammonium Bifluoride			
Westport Supply Exit Dry Cleaning Fluid	Laundry		
Stoddard Solvent		8052-41-3	- flammable??
Trade secret			
Ecolab Fabric Brightener	Laundry		
Hydrogen Peroxide		7722-84-1	
Nonylphenol Ethoxylate		9016-45-9	- APE
Ecolab Injection Sour	Laundry		- corrosive?
Formic Acid		64-18-6	
Nehaus Chemicals	Laundry		
Isopropyl Acetate		108-21-4	
Ecolab Liquid Force	Laundry		
Isopropyl Alcohol		67-63-0	
Nonylphenol Ethoxylate		9016-45-9	- APE
Ecolab Liquid Lusterfixe	Laundry		- corrosive?
Hydrofluosilicac acid		16961-83-4	
Liquid Hi-Chlor	Laundry		
Sod. Hypochlorite		7681-52-9	
Ecolab Liquid Texsoft Concentrate	Laundry		
Isopropyl Alcohol		67-63-0	
VanWaters & Rogers PERC	Laundry		
Carbon tetrachloride		56-23-5	- SARA, carcinogen
Epichlorohydrin		106-89-8	- SARA, repro
PERC		127-18-4	- SARA, carcinogen

Chemical	Use	CAS*	Basis for failure
Buffered Sour	Laundry		
Hydroxyacetic acid		79141	
Van Waters and Rogers	Laundry		
Streetar,Streetex and Streepro	trade secret claim for all constituents		
Strike	Laundry		
Isopropanol		67-63-0	
Alkaline Silicate		683-492-0	
Butoxyethanol		111-76-2	
Swan-Cote Spray	repellent		
PERC		127-18-4	- SARA, carcinogen
Shell Solvent		64741-65-7	
Aluminum Alcoholates		2269-22-9	
Non-Phosphate Tide	Laundry		
Sodium Silicates			
Alumine-silicates			
Sod. Carbonate			
Sod. Sulfate			
Westpo	Laundry		
Butyl Cellusolve		111-76-2	
PERC		127-18-4	- SARA, carcinogen
Aromatic 100		64742-95-6	
Pot. Hydroxide		1310-38-3	
(no contact with skin, eyes, clothing)			
MikroQuat Sanitizer	Roomclean		- corrosive
		11/6/9003	
amm. alkyl dimethylbenzyl chloride		68424-85-1 *	
		64-02-8	
monoethanolamine		141-43-5	
		7732-18-5	
Lemon Tub & Tile (Oasis) Roomclean			
Phosphoric acid		7664-38-2	
Citric acid		77-92-9	
Butoxyethanol		112-34-5	
Dimethyldodecamine oxide		1643-20-5	
Nonylphenol ethoxylate		9016-45-9	- APE

Chemical	Use	CAS*	Basis for failure
Formulator Multipurpose Cleaner	Roomclean		
Tetrasodium EDTA		64-02-8	- EDTA
		68439-57-6	
trisodium phosphate		7601-54-9	- phosphate
		9004-92-1	
Supershine Foaming Cleaner	Roomclean		
And Lemon Oil (Allstar)			
		8052-41-3	
isobutane		75-28-5	
propane		74-98-6	
General Purpose Spray Cleaner	Roomclean		
Butyl Cellusolve		111-76-2	
Isobutane		75-28-5	
Aqua Ammonia		01336-21-8	
Surfactant		09036-19-5	- APE
-			
Sanitizer MikroBac (Ecolab)	Roomclean		
Isopropyl alcohol		67-63-0	
Pot. O-phenylphenate		13707-65-8	
Pot. O-benzyl-P-Chlorophenate		35471-49-9	
Sod. Dodecylbenzenesulfonate		25155-30-0	
Pot. P-T-amylphenate		53404-18-5	
Amazing	Room clean		- corrosive?
Phosphoric acid		7664-38-2	- SARA
Oxalic acid		144-62-7	
Crusader	Room clean		
2-butoxyethanol		111-76-2	
Whisper	Room clean		
Isopropyl alcohol		67-63-0	
Sparkle	Kitchen		
Dyna Foam Oven	Kitchen		- corrosive?
		1310-58-3	
		131-73-2	
2-butoxyethanol		111-76-2	
-			
Diversey Stainless Steel Polish	Kitchen		

Chemical	Use	CAS*	Basis for failure
Ms. Muscle Oven and Grill	Kitchen		
(Drackett)		112-34-5	
Bleach	Kitchen		
Americlean encapsul	Kitchen		
Americlean low energy	Kitchen		
Sanitizer			
Sod. Hydroxide		1310-73-2	
Sod. Hypochlorite		7681-52-9	
Mildew Stain Remover	general area		
Sod. Hypochlorite		7681-52-9	
3M Carpet Spray Cleaner	general area		
2-butoxyethanol		111-76-2	
Fluroaliphatic acid salt		trade secret	
Styrene maleic anhydride resin		trade secret	
Ammonium Salt		26022-09-03	
Isopropyl Alcohol		67-63-0	
Coco Concentrated Lotion Hand Soap	Public restrooms		
Sod. Olefin Sulfonate		68439-57-6	
Sod. Lauryl Sulfonate		151-21-3	
Supershine Aerosol (wax polish)	general area	flammable?	
Petroleum Distillates		8052-41-3	
Isobutane/Propane		75-28-5	
		74-98-6	
3M Trouble Shooter Cleaner	general area		
2-Butoxyethanol		111-76-2	
Isobutane		75-28-5	
Ethanolamine		141-43-5	
Propane		74-98-6	
-			
3M Liquid Carpet Cleaner	general area		
2-Butoxyethanol		111-76-2	
Fluroaliphatic acid salt		trade secret	
Isopropyl Alcohol			
RIM Bowl Cleaner	toilets		
Phosphoric acid		7664-38-2	- SARA
Ethoxylated Nonylphenol		9016-45-9	- APE

Chemical	Use	CAS*	Basis for failure
Vanguard Graffiti Remover	outside walls		- flammable
Isopropyl Alcohol		67-63-0	
Toluene		108-88-3	- SARA, repro
Acetone		67-64-1	
Methanol		67-56-1	- SARA
Glycol Ether		111-78-2 (misprint?)	
Gum off Chewing Gum	spot clean		
Remover			
Isobutane		75-28-5	
Propane		74-98-6	
Marble Cleaner RTU	marble clean		
Isopropyl Alcohol		67-63-0	
QMC Marble Cleaner	marble clean		
Isopropyl Alcohol		67-63-0	
Ecolab Oasis 282/275	deodorizer		
Nonylphenol ethoxylate		9016-45-9	
Ecolab FX-3 Multisurface	common areas		
Maintenance			
Monoethanolamine soap		11/9/2272	
Ethanolamine (MEA)		141-43-5	
Ethylenediamine tetraacetic acid,		64-02-8	- EDTA
Tetrasodium salt			
Sod. Dodecylbenzenesulfonate		25155-30-0	
Nonylphenol ethoxylate		9016-45-9	- APE
Ecolab FX-Quarry Tile Shock	Tile Clean		- corrosive?
Citric acid		77-92-9	
Sulfonic acid		5329-14-6	
-			
Ecolab General Spray Cleaner	common areas		
Butoxyethanol		111-76-2	
Isobutane		75-28-5	
Ecolab Air Strike	common areas		
Nonylphenol ethoxylate		9016-45-9	- APE

Chemical	Use	CAS*	Basis for failure
Ecolab Multipurpose Liquid Cleaner	common areas		
Nonylphenol ethoxylate		9016-45-9	- APE
Baseshooter	wax stipper		
Glycol butyl ether		111-76-2	
Isobutane		75-28-5	
Monethanolamine		141-43-5	
3M Extractor	carpets		
Butoxyethanol		111-76-2	
Polyoxyethylene monooctylphenyl ether		9036-19-5	- APE
Sod. Tripolyphosphate		7758-29-4	- phosphates
Sod. Metasilicate		6834-92-0	
Sod. Xylene Sulfonate		1300-72-7	
3M Carpet Protector	carpets		
Butoxyethanol		111-76-2	
Isopropyl Alcohol		67-63-0	
1,1,2-trichloro-1,2,20trifluroethane		76-13-1	- SARA, ozone depletion
3M Carpet Spray Cleaner carpets			
Butoxyethanol		111-76-2	
Fluroaliphatic acid		trade secret	
Isopropyl Alcohol		67-63-0	
3M Carpet Stain Remover	carpets		
2-Butoxyethanol		111-76-2	
Cinch	carpets		
2-Butoxyethanol		11-76-2	
Monethanolamine		141-43-5	
Color Brite	unknown		
Sodium Bisulfate		7681-57-4	
(*not for people with asthma)			
-			
Cornerstone Floor Sealer	floors		
Modified acrylic polymer	trade secret		
Diethylene glycol ether		111-77-3	
Styrene Butadiene Polymer		9003-55-8	
Tri (butoxyethyl) Phosphate		78-51-3	- phosphate?

Chemical	Use	CAS*	Basis for failure
Enzyt Bowl Cleaner	toilets		
Sod. Carbonate		497-19-8	
Citric Acid		77-92-9	
Emergency CleanUp	Spot clean		
Diatomaceous Earth			
Cristobalite		144-64-1	
Quartz		14808-60-7	- carcinogen
Expert Marble Refinisher	marble		
Petroleum Distrillate		805-24-13	
Sorbitan Monolaurate		5959-89-7	
Expert Marble Maintainer	marble		
Diethylene glycol ethylether		111-90-0	
Expert Marble Activator	marble		- corrosive???
Oxalic Acid		144-62-7	
Ecolab First Impression	metal polish		
Metal Polish			
Ammonium hydroxide		1336-21-6	
Ecolab FX-3 Quarry Tile	tiles		
Degreaser			
Caustic soda		1310-73-2	
Ethylenediamine tetraacetic acid,		64-02-8	- EDTA
Tetrasodium salt			
MEA		141-43-5	
Ecolab Solid Acid Quarry Tile	tile		- corrosive???
Floor Cleaner			
Citric Acid		77-92-9	
Sulfonic Acid		5329-14-6	
Gold-N-Glow			
Mineral Spirits			
Toluene			- SARA, repro

Chemical	Use	CAS*	Basis for failure
Ecolab Glass Cleaner	glass clean		
Butoxyethanol (40%)		111-76-2	
Isopropyl Alcohol		67-63-0	
Ecolab Formulator Multipurpose General area			
Cleaner			
Ethylenediamine		64-02-8	
Ecolab Formulator Glass glass clean			
Cleaner			
Butoxyethanol (3%)		111-76-2	
Ecolab Formulator Bathroom guestroom			- corrosive?
Cleaner			
Phosphoric Acid		7664-38-2	- SARA
Butoxyethanol		111-76-2	
Ecolab Formulator Concentrate #3			- corrosive
(severe chemical burns)			
Sod. Hydroxide		1310-73-2	
Gum-Off	general		
Isobutane		75-28-5	
Ice Foe	perimeter		
Calcium Chloride		10043-52-4	
John Bowl Cleaner	toilets		- corrosive???
Hydrochloric Acid		7647-01-0	
alkyl demethylbenzyl amm. chloride		68391-01-5	
Kare-N-Shine			
Petroleum Spirits		8030-30-6	
Nonylphenol ethoxylate		9016-45-9	- APE
Isobutane		75-28-5	
Ecolab Lemon-Eze	bathroom		
Tub & Tile Cleaner			
Dodecylbenzene sulfonic acid		27176-87-0	

Chemical	Use	CAS*	Basis for failure
Lemon Polish	wood clean		- flammable?
Isoparaffinic hydrocarbons		64742-48-9	
Isobutane		75-28-5	
Propane		74-98-6	
Ecolab Lime-A-Way	toilets		
Phosphoric Acid		7664-38-2	- SARA
Husky 400	deodorant		
Detergents		25155-30-0	
		26027-38-3	
Ecolab Medallion Metal Polish	metal polish		
Mineral Spirits		64742-48-9	
Diethyleneglycol monobutyl ether		112-34-5	
Mineral oil		64742-80-9	
Ecolab MikroQuat	Disinfectant		
Alkyldimethylbenzyl amm. Chloride		68424-85-1	
MEA		141-43-5	
MSR Mildew Stain Remover	bath/spa		
Calcium hypochlorite		7778-54-3	
Professional Spotter	spot clean		
Diethylene glycol ethyl ether		111-90-0	
2-butoxyethanol		111-76-2	
Ecolab Oasis 255 Glass Cleaner	glass clean		
Butoxyethanol		111-76-2	
Isopropyl alcohol		67-63-0	
Ammonium hydroxide		1336-21-6	
3M Rinse Free Stripper	floor stripper		
2-butoxyethanol		111-76-2	
Ethanolamine (MEA)		141-43-5	
Ethoxylated secondary alcohols		68551-14-14	
Sulfonate		1300-72-7	
Ecolab Institutional Strength Scrub Free	toilets		
Phosphoric acid		7664-38-2	- SARA

Chemical	Use	CAS*	Basis for failure
Stance Floor Finish	floor finish		
Syrene Acrylontride polymer		9003-54-7	
Diethyleneglycol ether		111-77-3	
Tri (butoxyethanol) phosphate		78-51-3	
Dibutyl Phthalate		84-74-2	- SARA
Ecolab Top Quartile	floor cleaner		
Phosphoric acid		7664-38-2	- SARA
Butoxyethanol		111-76-2	
3M Trouble Shooter Cleaner			
Butoxyethanol		111-76-2	
Ethanolamine (MEA)		141-43-5	
Isobutane		75-28-5	
Propane		74-98-6	
Ethoxylated Secondary Alcohols		68131-40-8	
Wright's Brass Polish	brass clean		
Isopropanol		67-63-0	
Ammonium hydroxide		1336-21-6	
Oxalic Acid		144-62-7	
Steamette Liquid Extraction	fabric		
Nonyl Phenol Ethoxylate		9016-45-9	- APE
Tetrapotassium diphosphate		7320-34-351	- phosphate
Professional Spotter	fabric		
Diethylene Glycol ethylether		111-90-0	
2-butyoxyethanol		111-76-2	- APE
Kil-Oder Lemon Burst	Deoderizer		
Alkoxylated fatty alcohol		69227-21-0	
Linear primary alcohol ethoxylate		34398-01-1	
Step-Off			
Sod. Hydroxide		1310-73-2	
MEA		141-43-5	
Sod. Silicate			
Carefree			
Styrene acrylic polymer			
Diethylene glycol ethyl ether		111-90-0	
Ethylene glycol 2-ethylhexyl ether		1559-35-9	

Chemical	Use	CAS*	Basis for failure
Freedom Speed Stripper	floor		- corrosive?
Diethylene glycol ethyl ether		111-90-0	
MEA		141-43-5	
Sod. Metasilicate		6834-92-0	
Ethylene glycol phenyl ether		122-99-6	
Sod. Xylene Sulfonate		1300-72-7	
Noxon Metal Polish	metals		
Oxalic acid		144-62-7	
Silica		14808-60-7	- carcinogen
Ethyl alcohol		64-17-5	
Isopropyl Alcohol		67-63-01	
Ammonium hydroxide		1336-21-6	
Ecolab Oasis SF	glass cleaner		
2-butoxyethanol		111-76-2	
Propylene glycol n-propyl ether		1569-01-3	
Ammonium hydroxide		1336-21-6	
MEA		141-43-5	
Amphoteric and anionic surfactants			
Ecolab Oasis 301-NP	bath cleaner		
MEA		141-43-5	
Sod. Lauryl ether sulfate		9004-82-4	
Dipropylene glycol methyl ether			
Ethylenediamine tetraacetic acid		60-00-4	- EDTA
Ecolab Oasis 277	Deoderizer		
Nonylphenol ethoxylate		9016-45-9	- APE
Ecolab Rinse Dry	F&B rinse aid		
Nonanionic surfactants			
Ecolab First Impression	metal polish		
Ammonium hydroxide		1336-21-6	
Ecolab Lime-A-Way	delimer		- corrosive?
Phosphoric acid		7664-38-2	- SARA
-			
Ecolab Klenz-Glide 10	conveyor lube		
Potassium soap			
Ethylenediamine tetraacetic acid, tetrasodium salt 64-02-8			- EDTA

Chemical	Use	CAS*	Basis for failure
Ecolab Mikroklene	detergent disinfectant		- corrosive
Phosphoric acid		7664-38-2	- SARA
Butoxyethanol		111-76-2	
Ecolab Antibacterial Clean and Smooth	comb clean/disinf		
Ecolab Grease Cutter	oven degreaser		- corrosive
Sodium hydroxide		1310-73-2	
Butoxyethanol		111-76-2	
MEA		141-43-5	
Solitaire Hand Dish Detergent	Dish		
Sodium dodecylbenzenesulfonate		25155-30-0	
Sodium lauryl ether sulfate		9004-82-4	
Ecolab Maxi-Clean	multi purpose		
MEA		141-43-5	
Tetrasodium EDTA		64-02-8	- EDTA
Nonylphenol ethoxylate		9016-45-9	- APE
Ecolab Spray Cleaner	general purpose		
Butoxyethanol		111-76-2	
Isobutane		75-28-5	
Ecolab Automatic Drain Relief	drain cleaner		
2-Propanol		67-63-0	
Ecolab Solid Power	auto dish detergent		- corrosive
Sodium hydroxide		1310-73-2	
Ecolab Solid Insure	detergent (chlorinated) - comb clean/disinf		
Sodium hypochlorite		7681-52-9	
Ecolab Silver Power	silver pre-soak		
Sodium carbonate		487-19-8	

APPENDIX 3-5A – CHORRO VALLEY HISTORICAL STATE WATER DELIVERIES

State Water Project Deliveries - AF

	State Water Project Entitlement AF	Actual based on Sub-Contracts AF	2010	2011	2012	2013	4 year Average	Daily Population Served	20% Conservation Target Based on Average Usage
SLO County Operations Center	425	150	**87.3**	**95.4**	**118.7**	**122.8**	**106**	**1,229.00**	85
Operations Center			76.4	83.4	106.9	113.8	95	1,026.00	76
Office of Education[3]			10.2	11.2	10.7	8.4	10	200.00	8
Foster Ranch			0.7	0.8	1.2	0.6	1	3.00	0.7
Cuesta College[1]	200	160	**108.9**	**119.4**	**114.5**	**122.6**	**116**	**5,500.00**	93
California State Men's Colony[2]	400	715	**771.8**	**699.3**	**677.1**	**646.7**	**699**	**5,105.00**	559
Total	1025	1025	**968.0**	**914.1**	**910.3**	**892.1**	**921**	**11,834.00**	737

20% reduction based on Allocation 820

Notes:

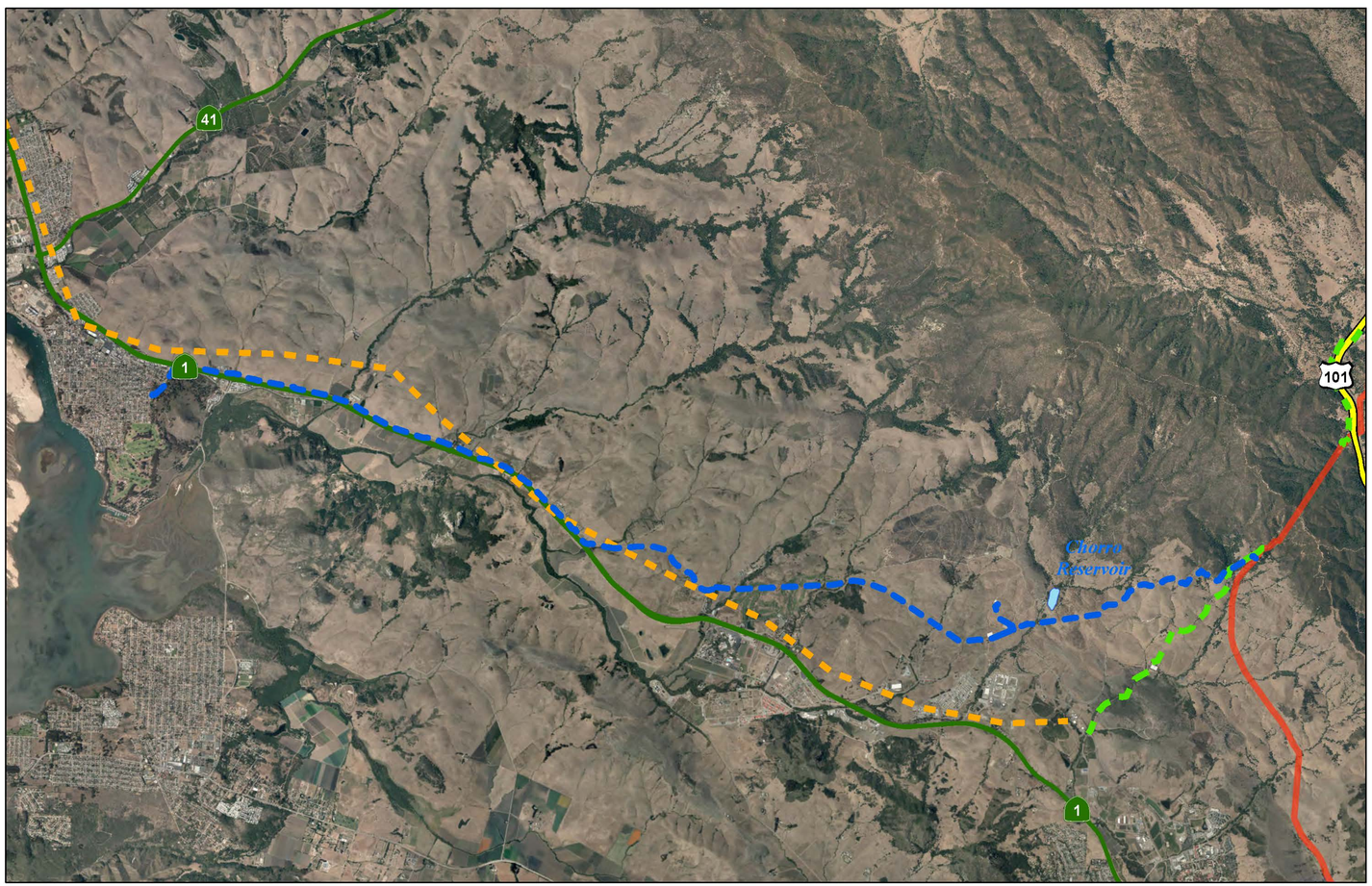
1. Per Director of Facilities Services T. Reece, water use is 50% domestic 50% Irrigation. Typical Daily Student Population is 5500
2. Avg inmate population from Jan - May 2015 4600 per CDCR. Number of employees in a 24 hour period is 1515/ 3 shifts = 505. Total =4600+505=5105 full time residents
3. Office of Education usage includes employees, potable water usage by Dairy Creek Golf Course (restaurant and bathrooms), El Chorro Regional Park (bathrooms) and a day camp. Estimated to be 200 people in a in an 8 hour period.

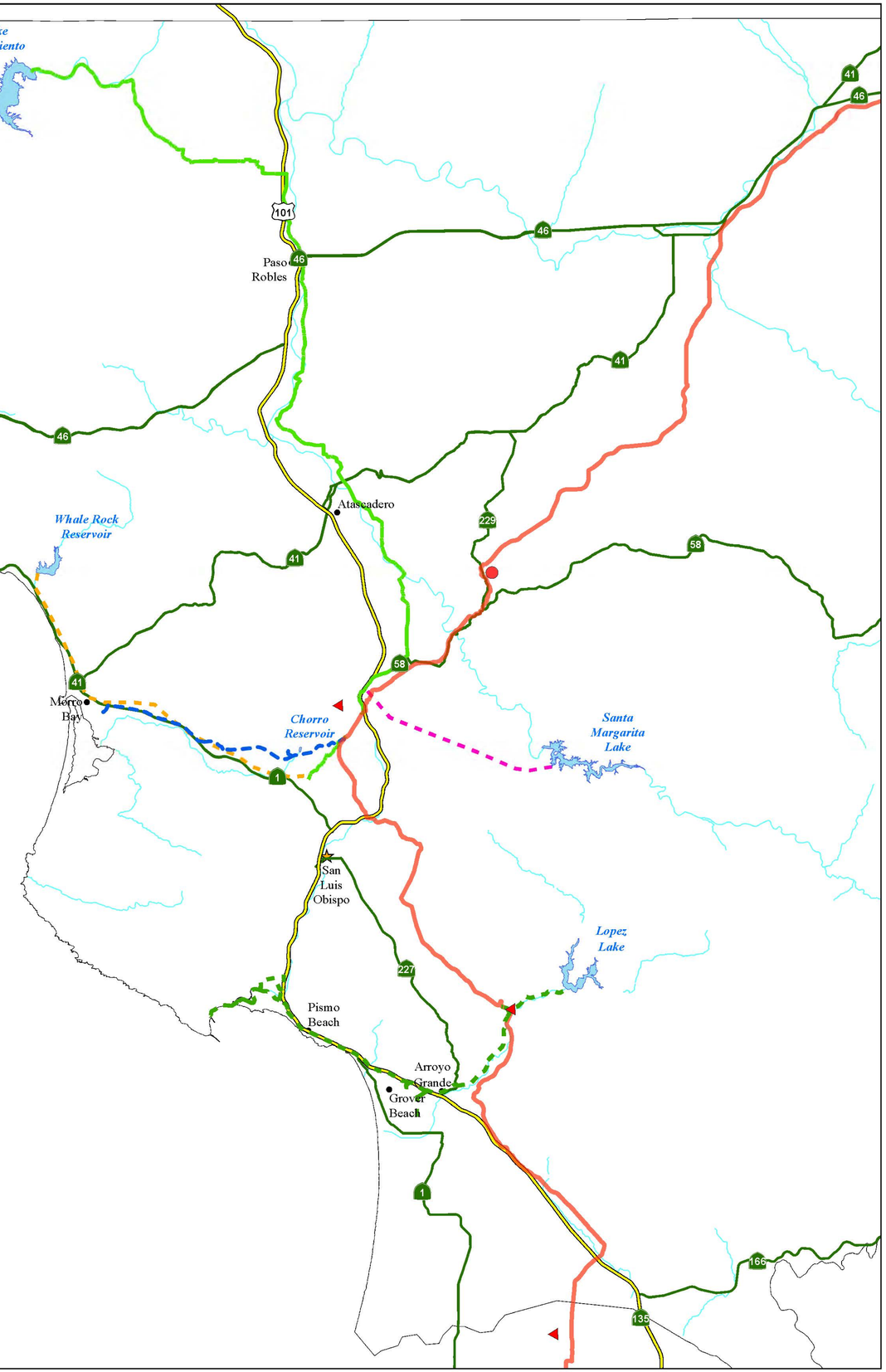
APPENDIX 3-5B – REGIONAL WATER SUPPLY AND DISTRIBUTION MAP

Legend

- State Project Water Tanks *
- State Project Turnout *
- State Water - Coastal Branch Pipeline
- State Water - Chorro Valley Pipeline
- Lopez Pipeline
- Whale Rock Pipeline *
- Salinas Reservior Pipeline *
- Nacimiento Pipeline
- US Highway
- State Highway
- Reserviors
- Major Streams
- County Boundary

*** Accuracy & Source of data is unknown**





APPENDIX 3-5C – CMC INTERTIE 30% DESIGN PLANS

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES 0 1 2 3

NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT

SHEET INDEX

SHEET #	SHEET TITLE
C-01	COVER SHEET AND KEY PLAN
C-02	ABBREVIATIONS AND GENERAL NOTES
C-07	PLAN & PROFILE - STATION 751+48.27 TO TBD
C-08	PLAN & PROFILE - STATION TBD TO TBD
C-09	PLAN & PROFILE - STATION TBD TO TBD
C-10	PLAN & PROFILE - STATION TBD TO TBD
C-11	PLAN & PROFILE - STATION TBD TO TBD
C-12	PLAN & PROFILE - STATION TBD TO TBD
C-13	PLAN & PROFILE - STATION TBD TO TBD
C-14	PLAN & PROFILE - STATION TBD TO TBD
C-15	NORTH PORTAL AREA TIE-IN PLAN
C-16	SAN LUIS OBISPO CITY BRANCH PLAN
C-17	CREEK CROSSING PLAN
C-18	CHORRO FILTRATION PLANT TIE-IN PLAN

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STATE OF CALIFORNIA

SIGNATURE

DATE SIGNED

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OWNER

SAN LUIS OBISPO COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT
COUNTY GOVERNMENT CENTER ROOM 207
SAN LUIS OBISPO, CA 93408

OWNER'S REPRESENTATIVE
SCOTT DUFFIELD / JILL OGREN
(805) 781-5252

CONTACT INFORMATION

REGISTERED CIVIL ENGINEER
TOM ZEHNDER, PE C72702, WALLACE GROUP
(805) 544-4011

REGISTERED ELECTRICAL ENGINEER
MIKE SCHLOEMER, PE E11062, DAMATT ENGINEERING, INC.
(510) 891-0970

SITE INFORMATION

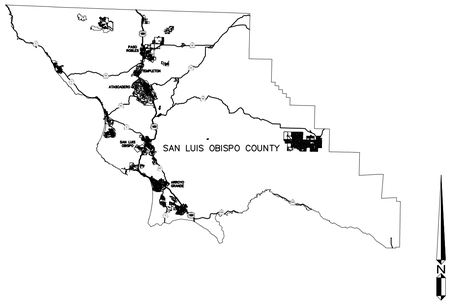
PROTOCOL FOR SITE ACCESS:
ALL SITE ACCESS SHALL BE COORDINATED VIA THE OWNER'S REPRESENTATIVE OR THEIR DESIGNEE. THE FOLLOWING INFORMATION MUST BE PROVIDED PRIOR TO ENTRY:

1. PHOTO ID
2. NAME, COMPANY REPRESENTING
3. COUNTY CONTACT PERSON
4. IF REQUIRED, APPOINTMENT FOR SITE SAFETY TRAINING

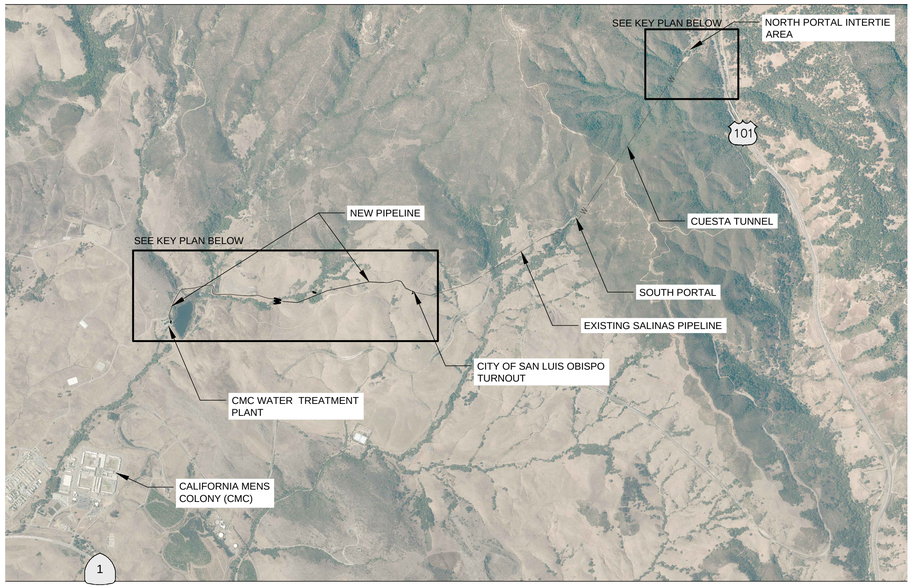
PROJECT DESCRIPTION

NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PROJECT (PROJECT) FOR THE SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT (DISTRICT) IS A CRITICAL DROUGHT RELIEF PROJECT TO CONVEY AVAILABLE RAW NACIMIENTO WATER TO THE CALIFORNIA MEN'S COLONY (CMC) WATER TREATMENT PLANT (WTP) VIA A SEGMENT OF THE SALINAS PIPELINE

THE PROJECT CONSISTS OF APPROXIMATELY 2 MILES OF PIPELINE INSTALLATION, INCLUDING A CREEK CROSSING AND NEW METERING STATIONS. AN EXISTING 1.2-MILE SECTION OF PIPE THAT WAS INSTALLED IN 1941 BUT NEVER COMPLETED WILL BE ABANDONED IN PLACE AND A NEW PIPELINE WILL BE INSTALLED ALONG THE SAME GENERAL ALIGNMENT.



VICINITY MAP
NTS



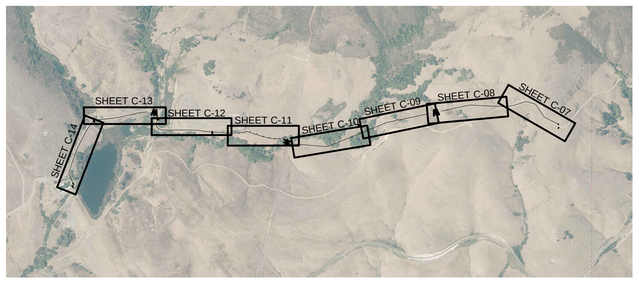
SITE LOCATION

N

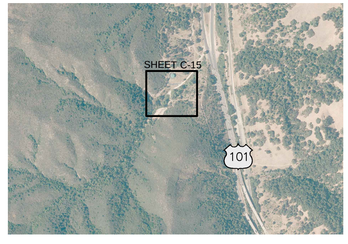
GRAPHIC SCALE
0 1000 2000 4000
(IN FEET)
1 IN = 2000 FT

GENERAL NOTES:

1. EXISTING PIPELINE INFORMATION SHOWN ON PLANS WAS BASED ON INFORMATION FROM THE FOLLOWING:
   - 1.1. CHORRO VALLEY PIPELINE - CHORRO VALLEY WATER TRANSMISSION PIPELINE PROJECT DRAWINGS, DATED 5/13/1994
   - 1.2. SALINAS PIPELINE - A COMBINATION OF GROUND SURVEY OF VISIBLE PIPELINE FEATURES AND MAPPING OF THE ORIGINAL DESIGN DRAWINGS PRODUCED BY LEEDS, HILL, BARNARD & JEWETT, DATED 9/2/1941.
2. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING EXISTING CONDITIONS BEFORE COMMENCING WITH ANY WORK.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL REQUIRED SPECIAL INSPECTIONS DURING CONSTRUCTION, PER THE CBC TABLES INCLUDED ON THIS SHEET. FINAL REPORTS OF ALL TESTS/INSPECTIONS SHALL BE PROVIDED TO THE OWNER'S REPRESENTATIVE.
4. A CERTIFICATE OF COMPLIANCE FROM ANY APPROVED FABRICATOR SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE UPON RECEIPT.
5. ALL WORK SHALL COMPLY WITH ALL CURRENT CODES, ORDINANCES & REGULATIONS OF APPLICABLE ADMINISTRATIVE AUTHORITIES;
   - 5.1. 2010 CBC
   - 5.2. COUNTY OF SAN LUIS OBISPO



KEY PLAN



KEY PLAN

Rev.	Date	Description of Revisions	By
3	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

SLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
COVER SHEET AND KEY PLAN

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 50/24/2014

DRAWING NO.
C-01
0 OF 0 SHEETS

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

ABBREVIATIONS

AC	ASPHALTIC CONCRETE
ACP	ASBESTOS CEMENT PIPE
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ARV	AIR RELEASE VALVE
A&V	AIR AND VACUUM (COMBINATION) VALVE
AVG	AVERAGE
BC	BEGIN CURVE
BF	BLIND FLANGE
BFV	BUTTERFLY VALVE
BIA	BUREAU OF INDIAN AFFAIRS
BLDG	BUILDING
BM	BENCH MARK
BO	BLOW OFF
BV	BALL VALVE
C	CURB
CAV	COMBINATION AIR VALVE
CATV	CABLE TELEVISION
CI	CAST IRON
CL	CENTERLINE
CL	CLASS
CMP	CORRUGATED METAL PIPE
CO	CLEANOUT
CONC	CONCRETE
CONST	CONSTRUCTION
CONT	CONTINUOUS
CP	CATHODIC PROTECTION
CPLG	COUPLING
CY	CUBIC YARD
DET	DETAIL
DIA	DIAMETER
DIM	DIMENSION
D/W	DRIVEWAY
E	EXISTING
EA	EACH
EC	END CURVE
ELE	ELEVATION
EP	EDGE OF PAVEMENT
EX	EXISTING
EG	EXISTING GROUND
FCA	FLANGE COUPLING ADAPTOR
FDC	FIRE DEPARTMENT CONNECTION
FF	FINISH FLOOR
FG	FINISH GRADE
FH	FIRE HYDRANT
FL	FLOW LINE
FL	FIRE LINE
FLG	FLANGE
FS	FINISH SURFACE
FT	FEET
G	GAS
GA	GAGE
GAL	GALLON
GALV	GALVANIZED
GB	GRADE BREAK
GPD	GALLONS PER DAY
GPM	GALLONS PER MINUTE
GV	GATE VALVE
HC	HANDICAP
HDPE	HIGH DENSITY POLYETHYLENE
HGL	HYDRAULIC GRADE LINE
ID	INSIDE DIAMETER
IN	INCHES
INV	INVERT
JP	JOINT POLE
JT	JOINT UTILITY TRENCH
L	LENGTH
LAT	LATERAL
LF	LINEAR FEET
LP	LIGHT POLE
LT	LEFT
M	METER
MAX	MAXIMUM
MIN	MINIMUM
MISC	MISCELLANEOUS
MH	MANHOLE
N/A	NOT APPLICABLE
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER
PCC	PORTLAND CEMENT CONCRETE
PH	POTHOLE (UTILITY WAS POTHOLED)
PIV	POST INDICATOR VALVE
POC	POINT OF CONNECTION
PRV	PRESSURE REGULATING VALVE
PSF	POUND PER SQURE FOOT
PSI	POUND PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
REQD	REQUIRED
RT	RIGHT
R/W	RIGHT OF WAY
RET WALL	RETAINING WALL
SS	SANITARY SEWER
SCH	SCHEDULE
SD	STORM DRAIN
SHT	SHEET
SPEC	SPECIFICATIONS
SSFM	SANITARY SEWER FORCE MAIN
STA	STATION
STD	STANDARD
STL	STEEL
SW	SIDEWALK
T	TELEPHONE
TB	THRUST BLOCK
TB	TOP OF BANK
TC	TOP OF CURB
TF	TOP OF FOOTING
TG	TOP OF GRATE
TP	TOP OF PAVEMENT
TYP	TYPICAL
TW	TOP WALL
UTL	COMMON TRENCH UTILITIES
VAR	VARIES
VC	VERTICAL CURVE
VIC	VICTAULIC COUPLING
VERT	VERTICAL
W	WATER
WF	WIDE FLANGE
WL	WATER LINE
WM	WATER METER
WS	WATER SERVICE
WV	WATER VALVE
WWM	WELDED WIRE MESH
WW	WET WELL

*NOTE: THIS IS A STANDARD SET OF ABBREVIATIONS.
NOT ALL ABBREVIATIONS SHOWN WILL APPLY TO THIS WORK.

LEGEND

EXISTING	PROPOSED	DESCRIPTION
(100.0 FS)	101.50 FS	SPOT ELEVATIONS
		SEWER MANHOLE
CO	CO	SEWER CLEANOUT
		SERVICE LATERAL (W=WATER, G=GAS, U=UTILITIES)
		SERVICE METER (W=WATER)
		DOUBLE SERVICE METER (W=WATER)
		SEWER LATERAL
		FIRE HYDRANT
		STORM DRAIN MANHOLE
		STORM DRAIN CATCH BASIN
		GATE VALVE
		CAP
		SURVEY MONUMENT
BPT	BPT	BENCH MARK
(2.00)%	2.00%	SLOPE PERCENTAGE
		ABANDON UTILITY
		EDGE OF PAVEMENT
		REDUCER / INCREASER
W	W	WATER LINE
SSFM	SSFM	SEWER FORCE MAIN
SS	SS	GRAVITY SEWER LINE
SD	SD	STORM DRAIN
G	G	UNDERGROUND GAS LINE
U	U	UNDERGROUND UTILITY LINE LOCATION
E	E	UNDERGROUND ELECTRICAL LINE
CTV	CTV	UNDERGROUND CABLE TELEVISION LINE
T	T	UNDERGROUND TELEPHONE LINE
		RIGHT OF WAY
		EASEMENT
		CENTERLINE
	X (BW)	BARBED WIRE FENCE
	X (CL)	CHAIN LINK FENCE
		RETAINING WALL
		FLOWLINE

811
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SLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
ABBREVIATIONS AND GENERAL NOTES

JOB #:	0019-0080
DESIGNERS:	ENG1
DRAWN BY:	ENG2
DATE:	50/24/2014

DRAWING NO.
C-02
0 OF 0 SHEETS

Rev.	Date	Description of Revisions	By
A	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

FILE NAME: 0019080 CD.DWG

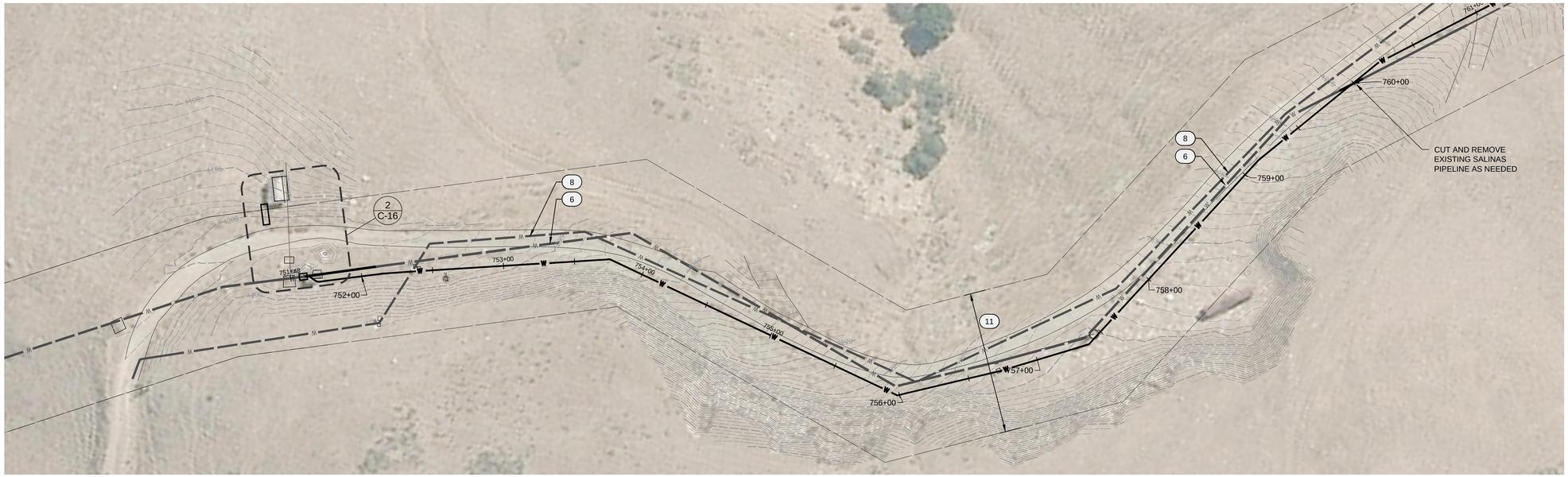
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

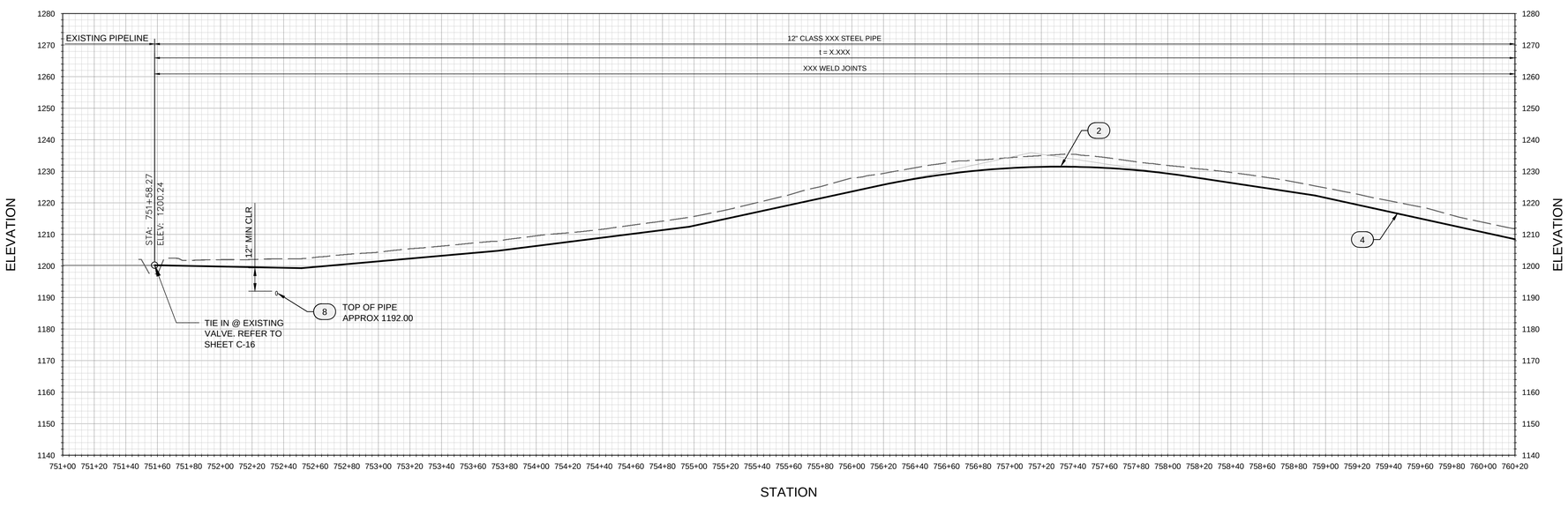
LEGEND

- NEW WATERLINE
- EXISTING WATERLINE
- EASEMENT
- EXISTING FENCE

CONSTRUCTION NOTES:

XXX	DESCRIPTION
1	NEW PIPELINE
2	AIR RELEASE VALVE
3	BLOW OFF VALVE
4	CONCRETE ANCHOR BLOCK
5	EXISTING GRADE
6	EXISTING 18" 1/4" PL STEEL PIPE (SALINAS PIPELINE) ABANDON IN PLACE
7	EXISTING 12" 1/4" PL STEEL PIPE (SALINAS PIPELINE) ABANDON IN PLACE
8	EXISTING 16" CL200 (CHORRO VALLEY PIPELINE) PROTECT IN PLACE
9	STAND PIPE
10	EXISTING CONCRETE TERMINAL STRUCTURE. DEMOLISH AND REMOVE
11	100 FT WIDE EASEMENT FOR EXISTING SALINAS PIPELINE





GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

VERTICAL
GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

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SLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

JOB #:	0019-0080		
DESIGNERS:	ENG1		
DRAWN BY:	ENG2		
DATE:	50/24/2014		

DRAWING NO.
C-07
0 OF 0 SHEETS

Rev.	Date	Description of Revisions	By
A	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

LEGEND

W	NEW WATERLINE
W	EXISTING WATERLINE
	EASEMENT
X X	EXISTING FENCE

CONSTRUCTION NOTES:

XXX	DESCRIPTION
1	NEW PIPELINE
2	AIR RELEASE VALVE
3	BLOW OFF VALVE
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5	EXISTING GRADE
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11	100 FT WIDE EASEMENT FOR EXISTING SALINAS PIPELINE

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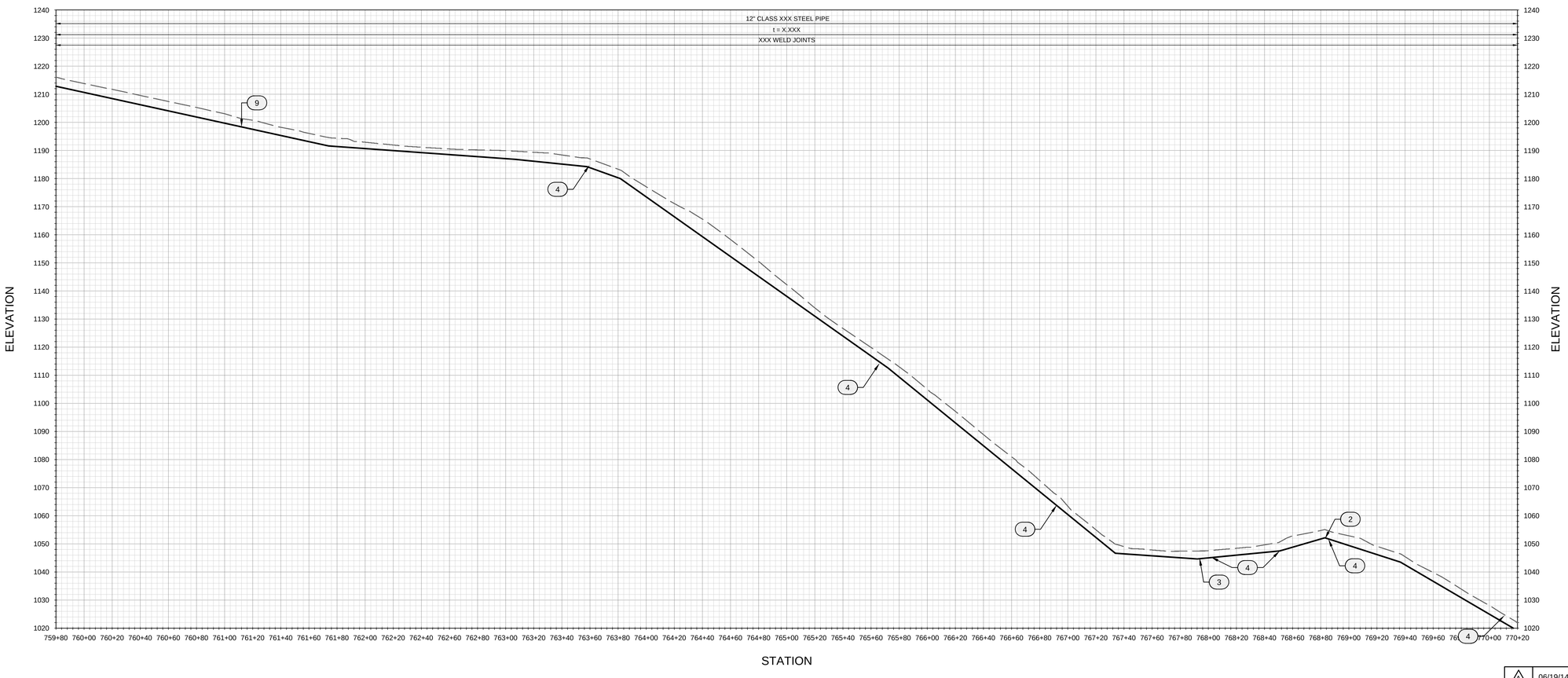
(IN FEET)
1 IN = 40 FT



GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

Rev.	Date	Description of Revisions	By
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SLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 50/24/2014

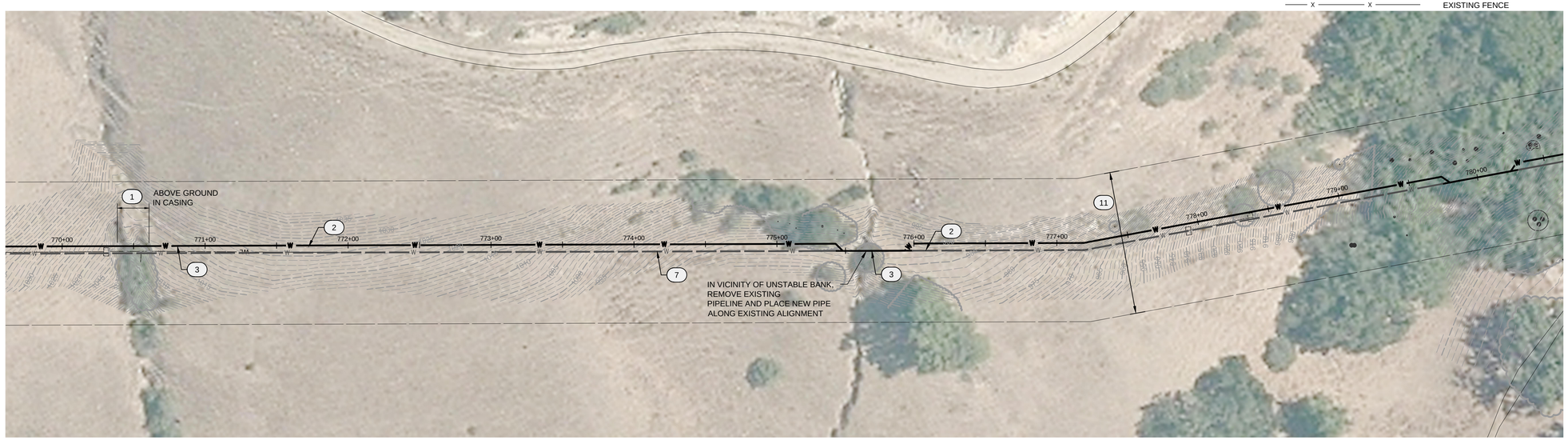
DRAWING NO.
C-08
0 OF 0 SHEETS

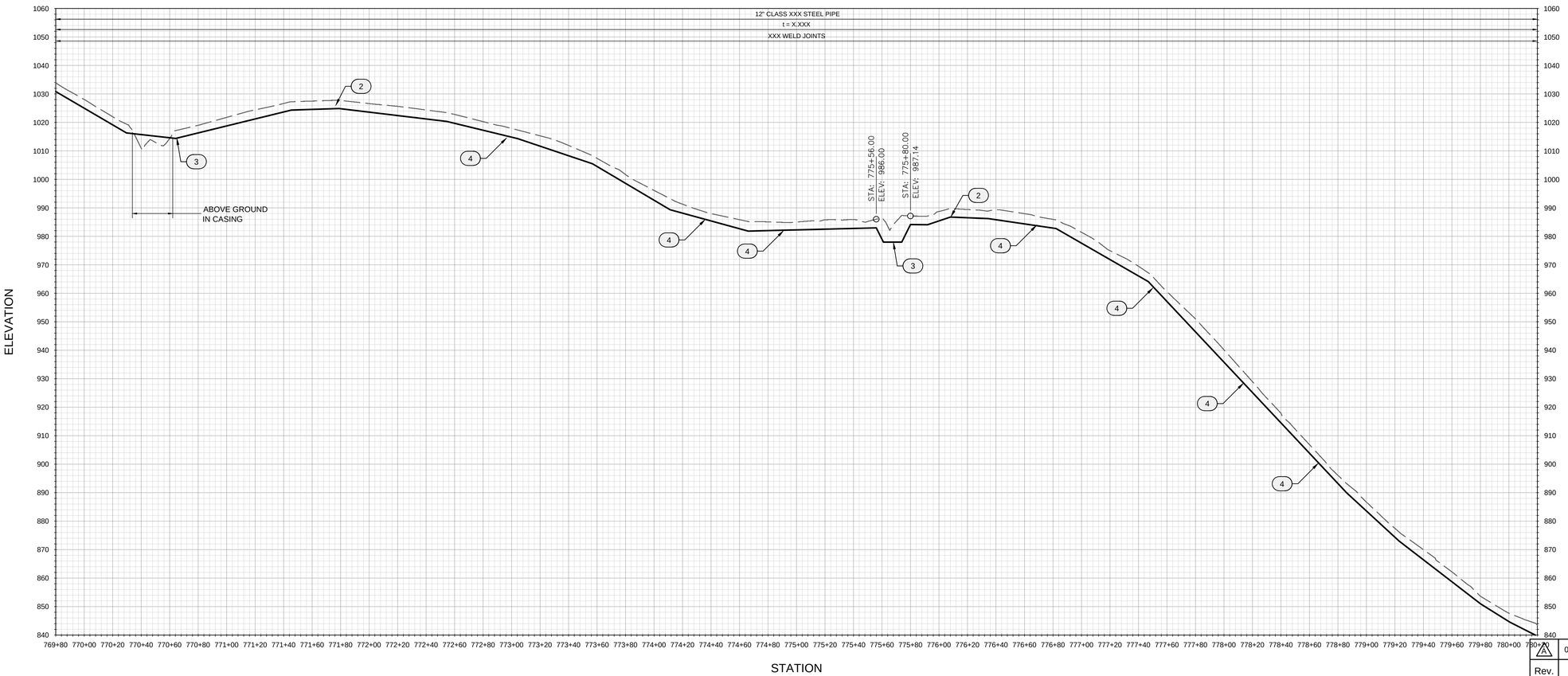
FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

LEGEND

W	NEW WATERLINE
W	EXISTING WATERLINE
	EASEMENT
X X	EXISTING FENCE





CONSTRUCTION NOTES:

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N

GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

VERTICAL
GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

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SLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

Rev.	Date	Description of Revisions	By
A	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 50/24/2014

DRAWING NO.
C-09
0 OF 0 SHEETS

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

LEGEND

W	NEW WATERLINE
W	EXISTING WATERLINE
	EASEMENT
X X	EXISTING FENCE

CONSTRUCTION NOTES:

XXX	DESCRIPTION
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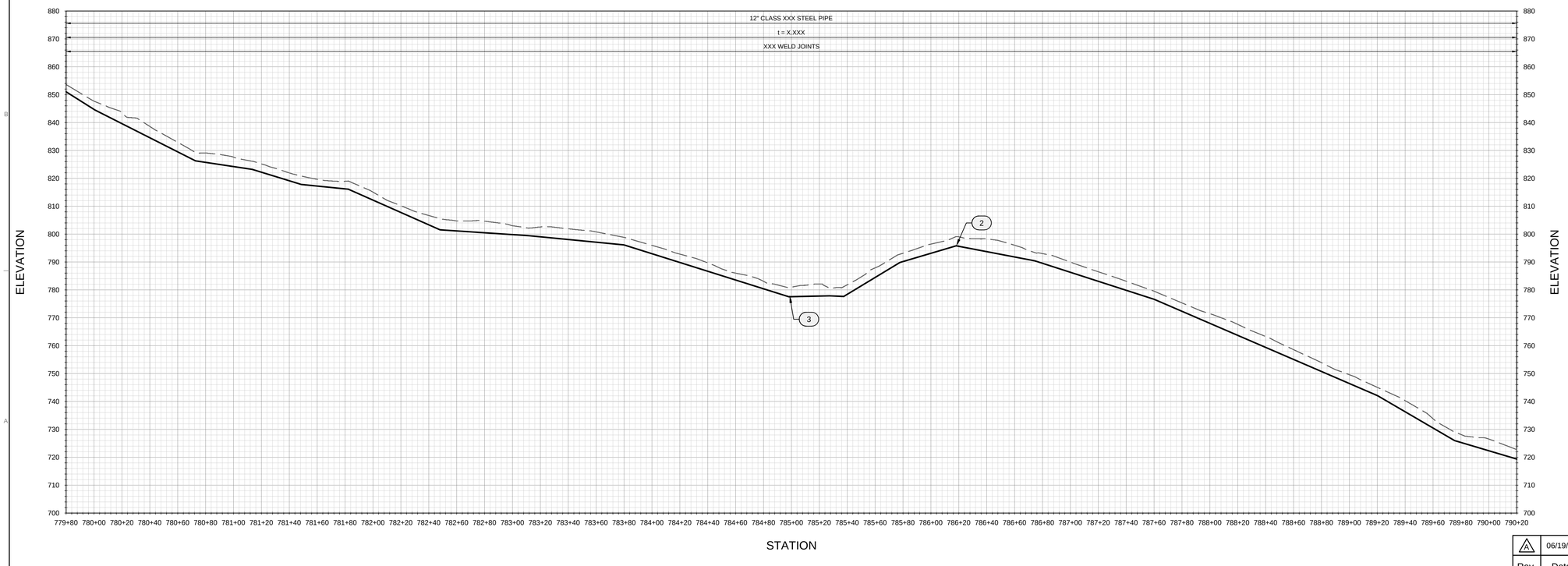
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT



VERTICAL
GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

Rev.	Date	Description of Revisions	By
A	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

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NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 51/24/2014

DRAWING NO.
C-10
0 OF 0 SHEETS

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

LEGEND

W	NEW WATERLINE
W	EXISTING WATERLINE
	EASEMENT
X X	EXISTING FENCE

CONSTRUCTION NOTES:

XXX	DESCRIPTION
1	NEW PIPELINE
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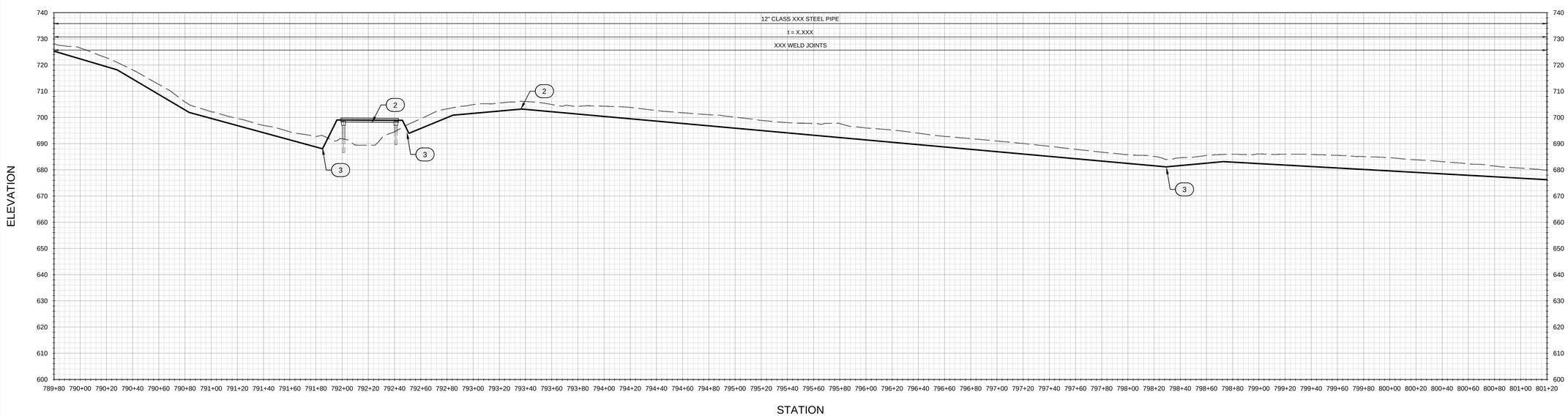
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

N



HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

VERTICAL
GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

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A	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

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NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 51/24/2014

DRAWING NO.
C-11
---- OF 0 SHEETS

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

LEGEND

W	NEW WATERLINE
W	EXISTING WATERLINE
	EASEMENT
X X	EXISTING FENCE

CONSTRUCTION NOTES:

XXX	DESCRIPTION
1	NEW PIPELINE
2	AIR RELEASE VALVE
3	BLOW OFF VALVE
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5	EXISTING GRADE
6	EXISTING 18" 1/4" PL STEEL PIPE (SALINAS PIPELINE) ABANDON IN PLACE
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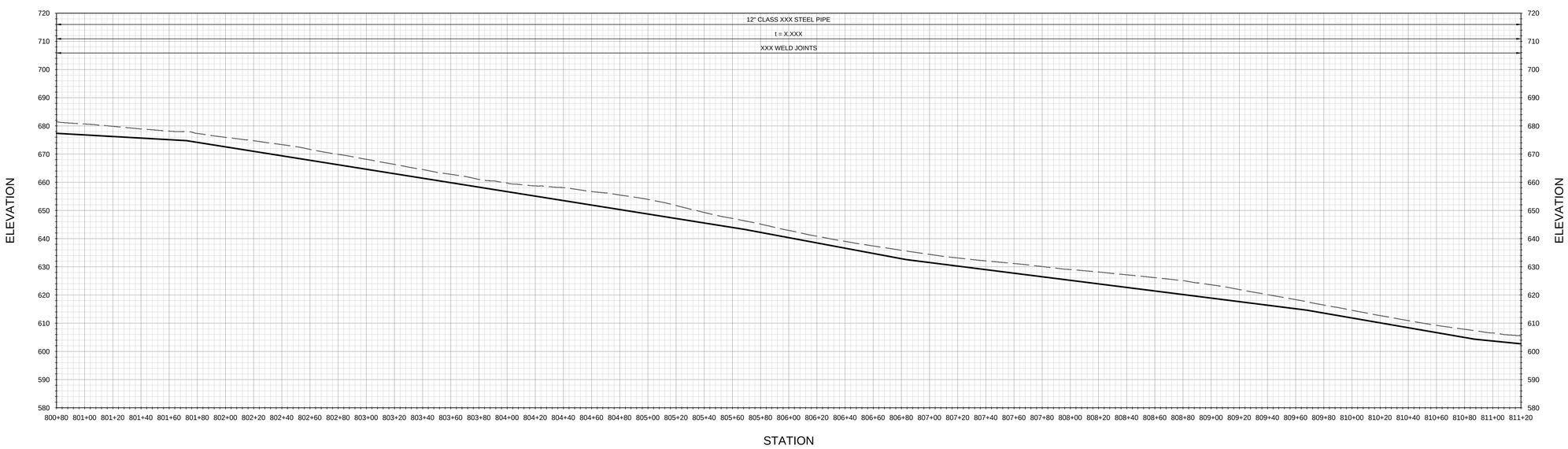
11	100 FT WIDE EASEMENT FOR EXISTING SALINAS PIPELINE

N

GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT



VERTICAL
GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

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NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

Rev.	Date	Description of Revisions	By
A	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 51/24/2014

DRAWING NO.
C-12
0 OF 0 SHEETS

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

LEGEND

—— W ——	NEW WATERLINE
— — — — W —	EXISTING WATERLINE
	EASEMENT
—— X —— X ——	EXISTING FENCE

CONSTRUCTION NOTES:

XXX	DESCRIPTION
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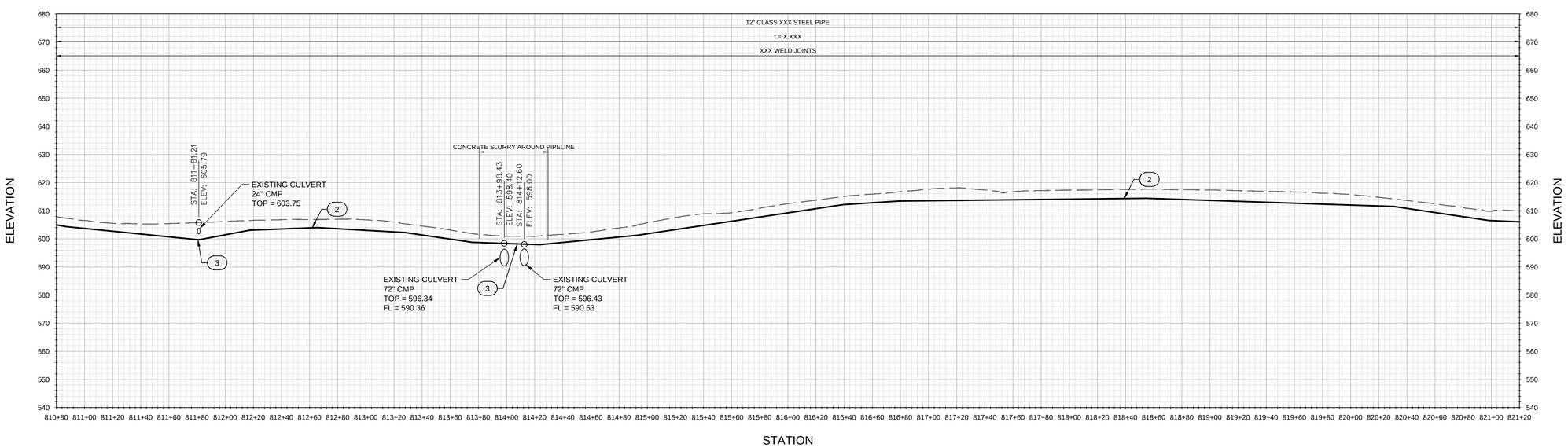

N

GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

VERTICAL
GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

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SLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

Rev.	Date	Description of Revisions	By
A	06/19/14	ISSUED FOR 30% PROGRESS REVIEW	TKZ

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 51/24/2014

DRAWING NO.
C-13
0 OF 0 SHEETS

FILE NAME: 0019080 CD.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

LEGEND

—W—	NEW WATERLINE
— — W — —	EXISTING WATERLINE
— — — —	EASEMENT
—x—x—	EXISTING FENCE

CONSTRUCTION NOTES:

XXX	DESCRIPTION
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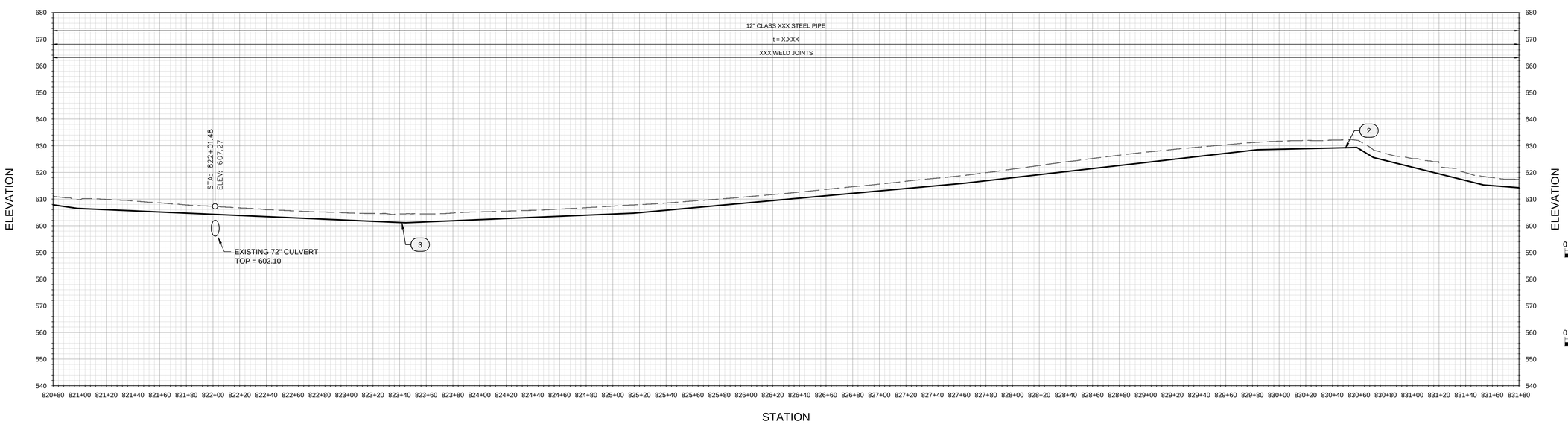
(IN FEET)
1 IN = 40 FT



VERTICAL
GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 IN = 20 FT

HORIZONTAL
GRAPHIC SCALE
0 20 40 80
(IN FEET)
1 IN = 40 FT

Rev.	Date	Description of Revisions	By
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SLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
PLAN & PROFILE

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 52/24/2014

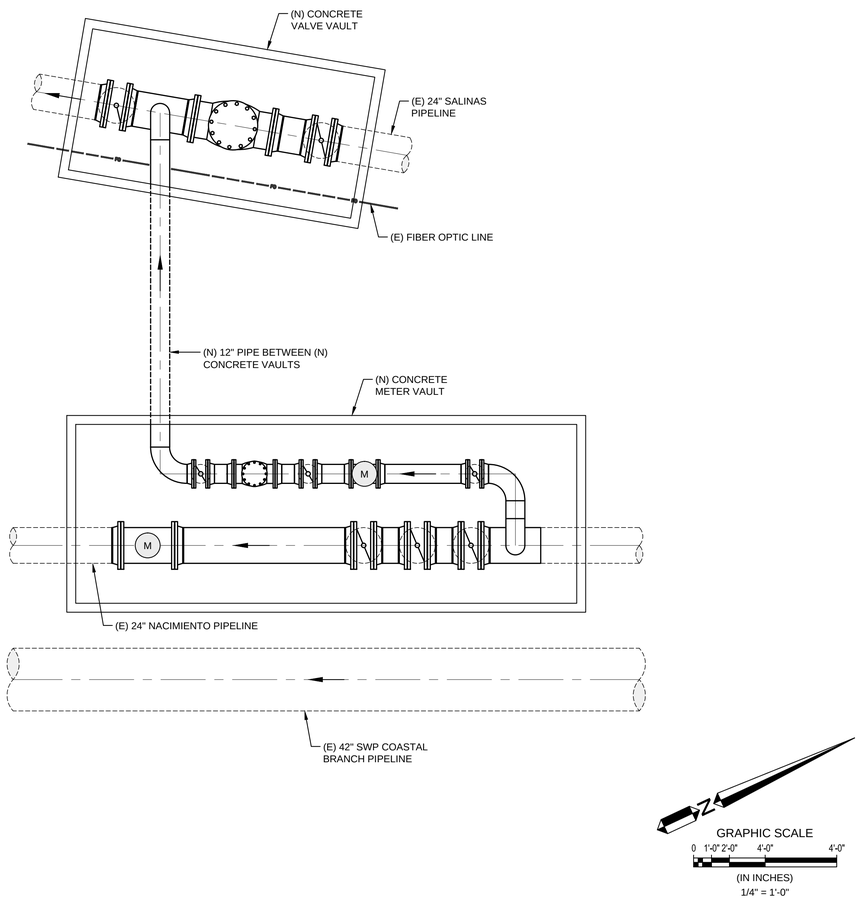
DRAWING NO.
C-14
0 OF 0 SHEETS

FILE NAME: 0019080 CD DETAILS.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

NORTH PORTAL AREA TIE-IN PLAN

SCALE: 1' = 40'



1 - NORTH PORTAL AREA TIE-IN PIPING DETAIL

SCALE: 1/4" = 1'-0"

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NORTH PORTAL AREA TIE-IN PLAN

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JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 03/24/2014

DRAWING NO.
C-15

FILE NAME: 0019080 CD DETAILS.DWG

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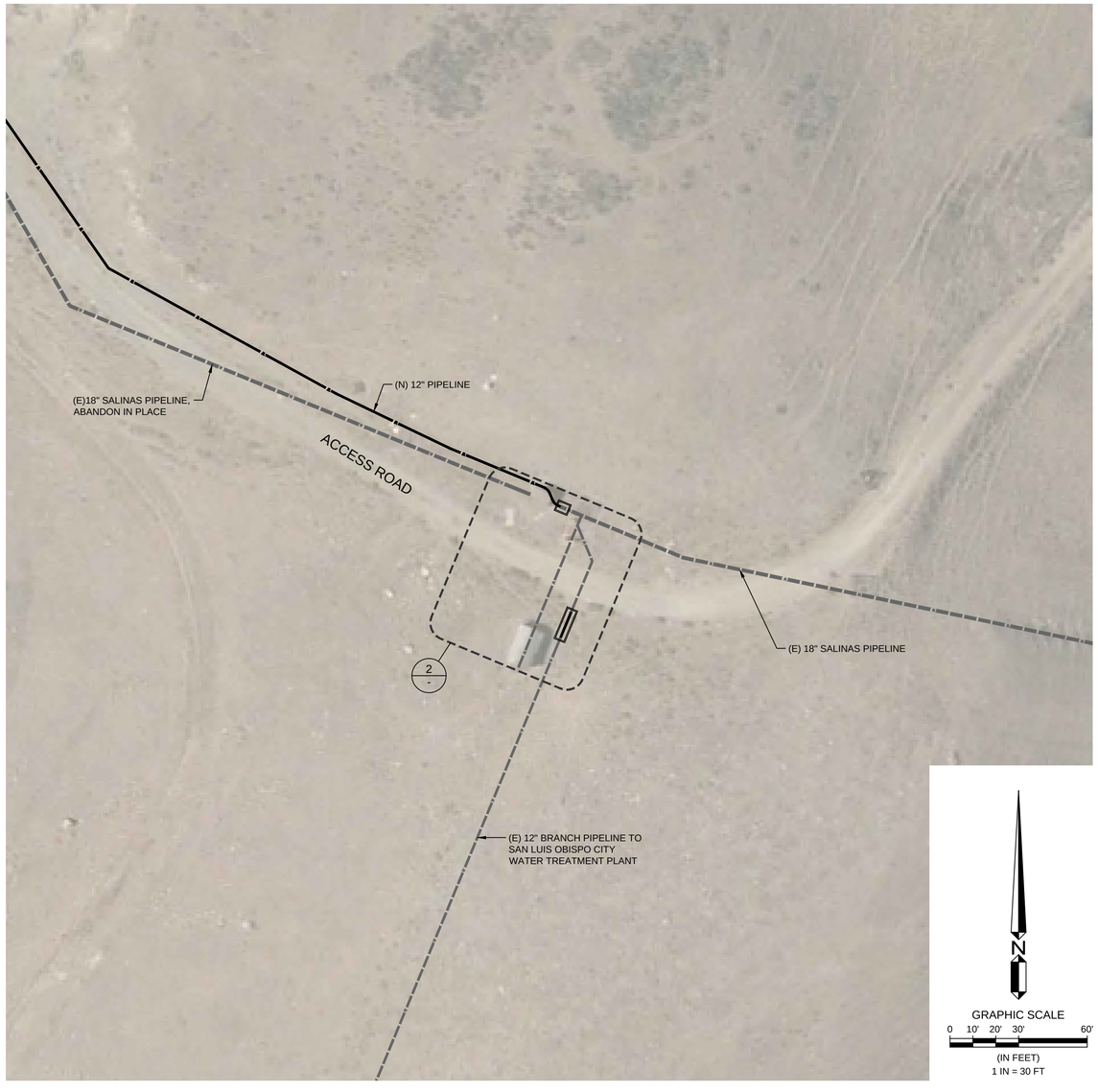
ORIGINAL SCALE IS IN INCHES

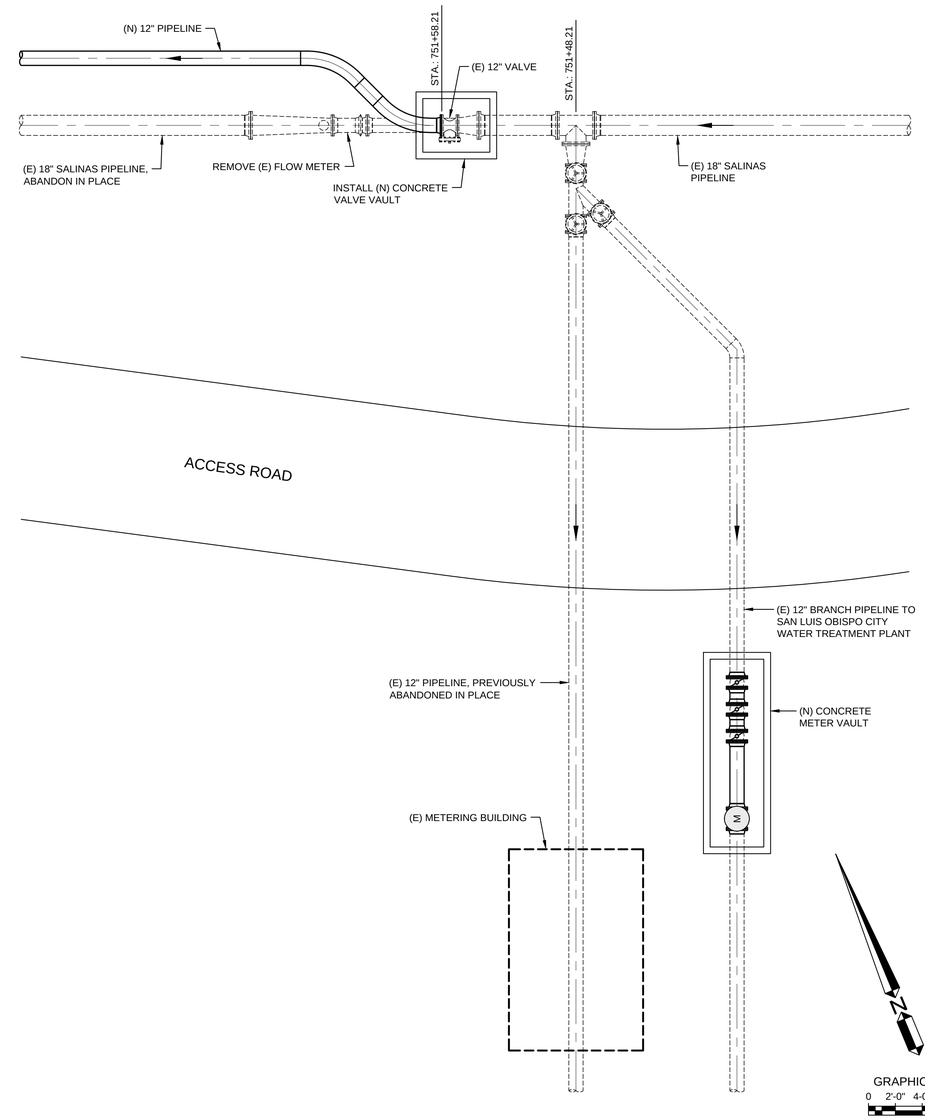


N

GRAPHIC SCALE
0 10' 20' 30' 60'
(IN FEET)
1 IN = 30 FT

SAN LUIS OBISPO CITY BRANCH PLAN

SCALE: 1' = 30'



N

GRAPHIC SCALE
0 2'-0" 4-0" 8'-0"
(IN INCHES)
3/16" = 1'-0"

2
-
SAN LUIS OBIPSO CITY BRANCH PIPING DETAIL

SCALE: 3/16" = 1'-0"

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NACIMIENTO-SALINAS-CMC EMERGENCY INTERTIE PIPELINE PROJECT
SAN LUIS OBISPO CITY BRANCH PLAN

JOB #:	0019-0080
DESIGNERS:	ENG1
DRAWN BY:	ENG2
DATE:	53/24/2014

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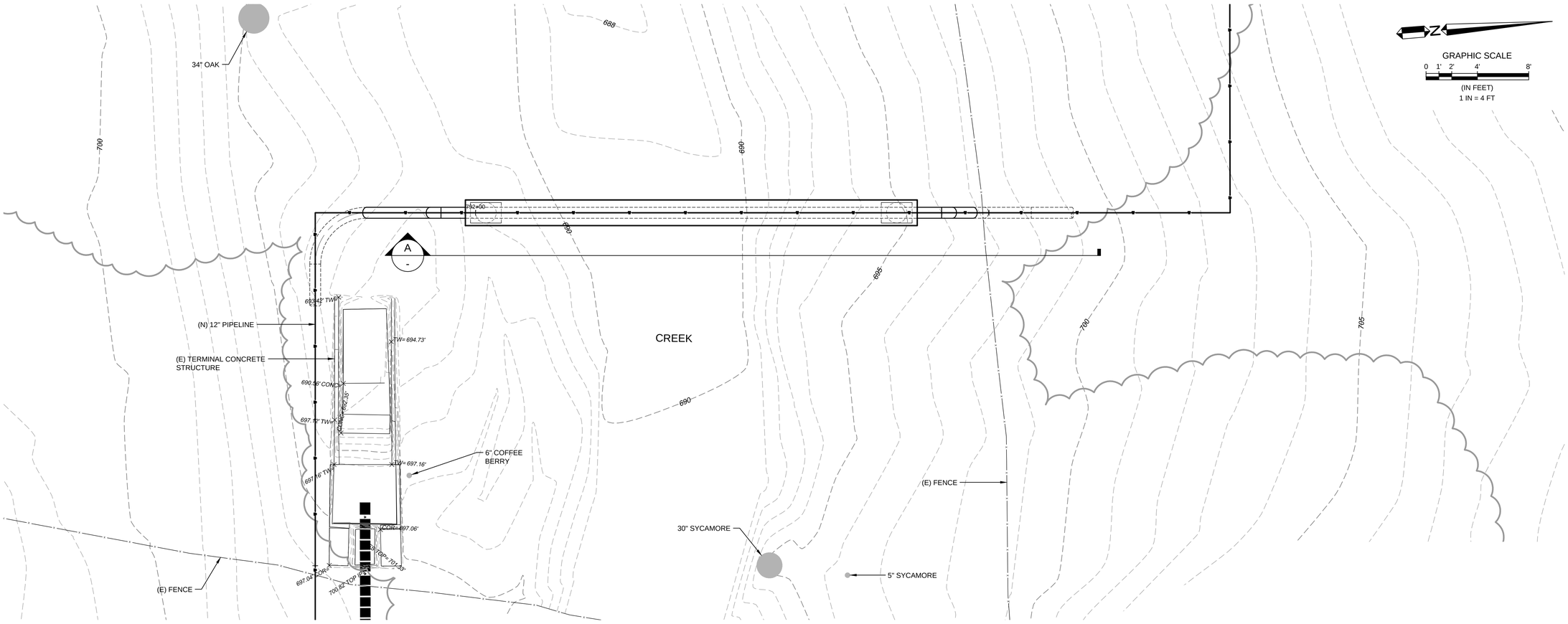
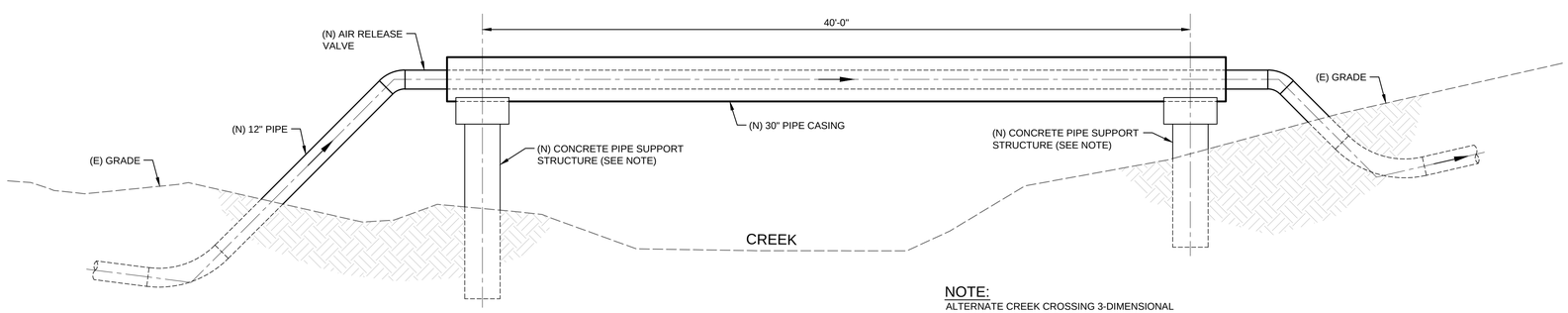


CREEK CROSSING PLAN

SCALE: 1" = 4'



NOTE:
ALTERNATE CREEK CROSSING 3-DIMENSIONAL TRUSS BRIDGE MAY BE DESIGN AND USED.

GRAPHIC SCALE
0 1'-0" 2'-0" 4'-0" 4'-0"
(IN INCHES)
1/4" = 1'-0"

A
-
CREEK CROSSING SECTION

SCALE: 1/4" = 1'-0"

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CREEK CROSSING PLAN

JOB #: 0019-0080
DESIGNERS: ENG1
DRAWN BY: ENG2
DATE: 53/24/2014

DRAWING NO.
C-17
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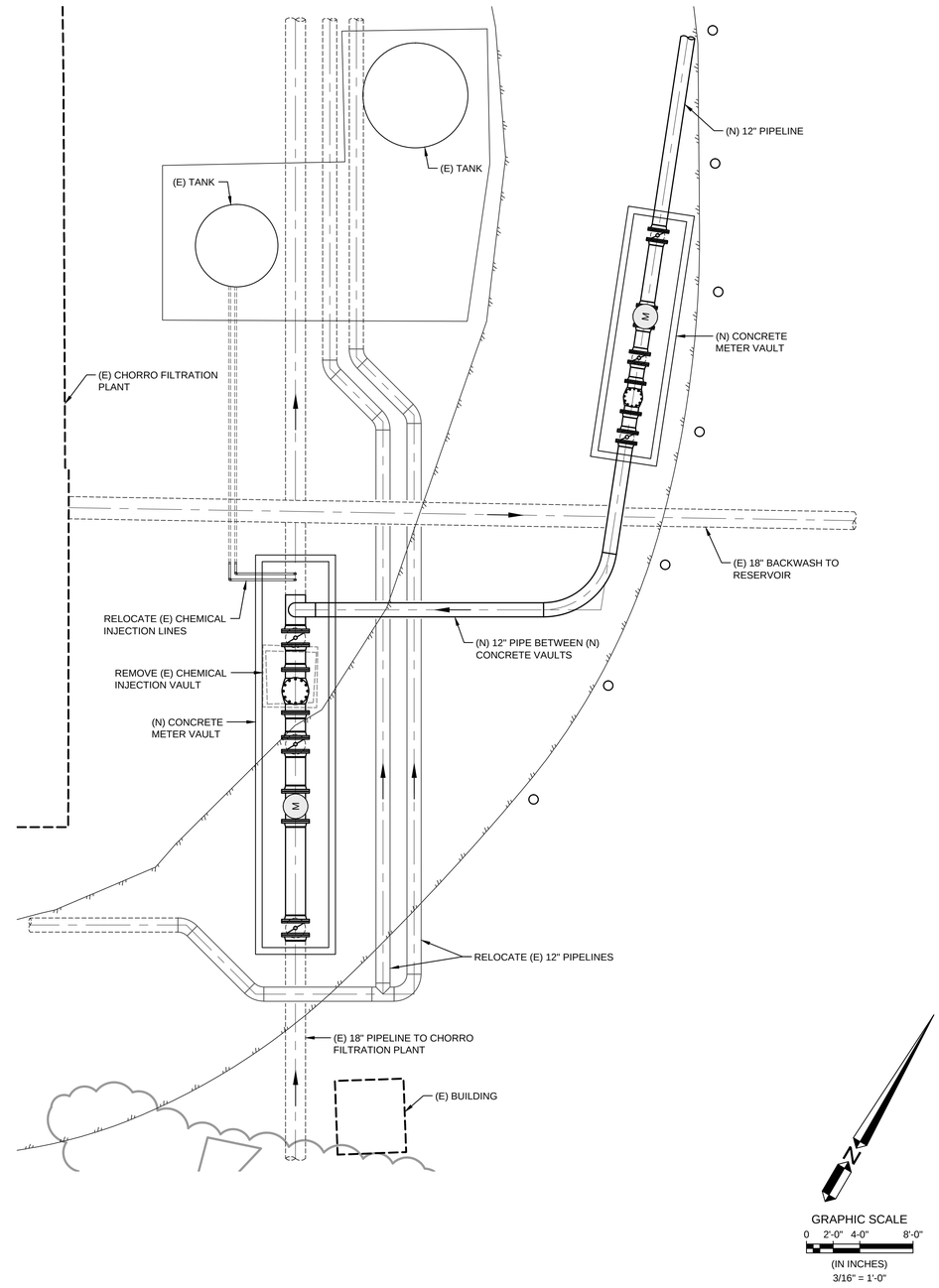
FILE NAME: 0019080 CD DETAILS.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

CHORRO FILTRATION PLANT TIE-IN PLAN

SCALE: 1' = 20'



3
-
CHORRO FILTRATION PLANT TIE-IN PIPING DETAIL

SCALE: 3/16" = 1'-0"

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DATE: 54/24/2014

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APPENDIX 3-5D – NACIMIENTO RESERVOIR WATER ALLOCATIONS

CHAPTER 110: PROJECT BACKGROUND

(Revision: 1.000)

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CHAPTER 110: PROJECT BACKGROUND

110.1 INTRODUCTION

The Nacimiento Water Project (NWP or Project) is a regional raw water transmission facility that will deliver water from Lake Nacimiento to communities in San Luis Obispo County (County). The San Luis Obispo County Flood Control and Water Conservation District (District) is the Owner of the Project. Other agencies that have confirmed participation in the project (the "Initial Participants") are the City of El Paso de Robles (Paso Robles), Atascadero Mutual Water Company (AMWC), Templeton Community Services District (TCSD), and the City of San Luis Obispo (SLO). County Service Area 10, Benefit Zone A (CSA10A) also joined as a Participant later. Each of the Participants executed a Water Delivery Entitlement Contract (WDEC) with the District to receive a portion of the NWP water supply.

110.2 PROJECT HISTORY

The Project history is depicted in the events listed below:

- 1959 - The District entered into an Agreement with Monterey County Water Resources Agency (MCWRA) for an annual entitlement of 17,500 acre-feet (AF) within Lake Nacimiento.
- 1995 - The County Environmental Coordinator issued a Notice of Preparation (NOP) for an Environmental Impact Report (EIR) on the NWP and retained Boyle Engineering Corporation, Carollo Engineers, and Ogden Environmental and Energy Services as Project Manager, Engineering Consultant, and Environmental Consultant, respectively.
- 1996 - A revised NOP was issued for the EIR based on changes in the Project description.
- 1996 - A Draft Engineering Report entitled Nacimiento Water Supply Project-Phase II, Draft EIR Preparation Phase Engineering Report was submitted by Carollo Engineers.
- 1997 - The Nacimiento Water Supply Project Draft EIR was submitted by Ogden Environmental and Energy Services.
- 1999 - Boyle Engineering Corporation submitted the Nacimiento Water Supply Project, Pipeline Alignment, and Profile.
- 2002 - Carollo Engineers submitted the Nacimiento Project, EIR Preparation Phase Engineering Report, Updated Draft.
- 2002 - Marine Research Specialists was appointed for the preparation of the Final EIR for the NWP.
- 2003 - Marine Research Specialists submitted the Final EIR.

- January 6, 2004 - District's Board of Supervisors certified the Final EIR, adopted the Notice of Determination, and directed County staff to conduct actions needed to implement the "raw water" Project alternative.
- August 17, 2004 - District's Board of Supervisors executed WDECs with Initial Participants.
- 2005 - A Black & Veatch-led team, which included Boyle Engineering Corporation and other subconsultants, was selected as the design engineering consultant for the Project.
- 2005 to 2007 - The Design Phase was conducted by the Black & Veatch led team.
- October 24, 2006 - District's Board of Supervisors executed WDEC with Other Participant (CSA10A).
- 2007 to 2010 - The Construction Phase was conducted.
- 2010 - Operation of the system began.

110.3 PROJECT DESIGN AND FACILITIES

The Project is designed to include the facilities listed in Table 110-1.

Table 110-1: Summary of NWP Facilities

Facility Type	General Description	Specific Components
NWP Intake	NWP Intake, constructed near the left abutment of Nacimiento Dam	Multi-port intake pipe with intake screens and hydraulically-actuated isolation valves, and intake tunnel interconnecting with the intake shaft.
Intake Pump Station at Lake Nacimiento	Intake Pump Station (IPS) constructed in conjunction with the NWP Intake.	Five (5) vertical diffusion vane pumps, a surge tank, pump station building, and electrical transformer yard.
Transmission Pipeline	Approximately 45 miles of welded steel and ductile iron pipeline ranging in size from 36 to 12 inches in diameter.	Pipeline sectionalized into Units A-H1.
Storage Tanks	Three raw water storage tanks constructed on three sites.	Camp Roberts Tank (CRT) Rocky Canyon Tank (RCT) Cuesta Tunnel Tank (CTT)
Intermediate Pump Stations	Two pump stations to transfer water between the water storage tanks.	Santa Ysabel Pump Station (SYPS) Rocky Canyon Pump Station (RCPS)
Turnouts	Four turnouts (for delivery of water to the Participants) consisting of piping, instrumentation, and appurtenant facilities.	Paso Robles Turnout (T2) TCSD Turnout (T4) AMWC Turnout (T6) SLO/CSA10A Turnout (T11)
Project Controls	Supervisory Control and Data Acquisition (SCADA) systems located at pump stations, tanks, and turnouts.	Project Control Center at Santa Margarita Booster Pump Station
Electrical Power Supply	Service extensions to IPS and SYPS. Service connections at all facility locations.	Local electrical improvements

The Project facilities are split into multiple units, details of which are provided in the subsequent sections.

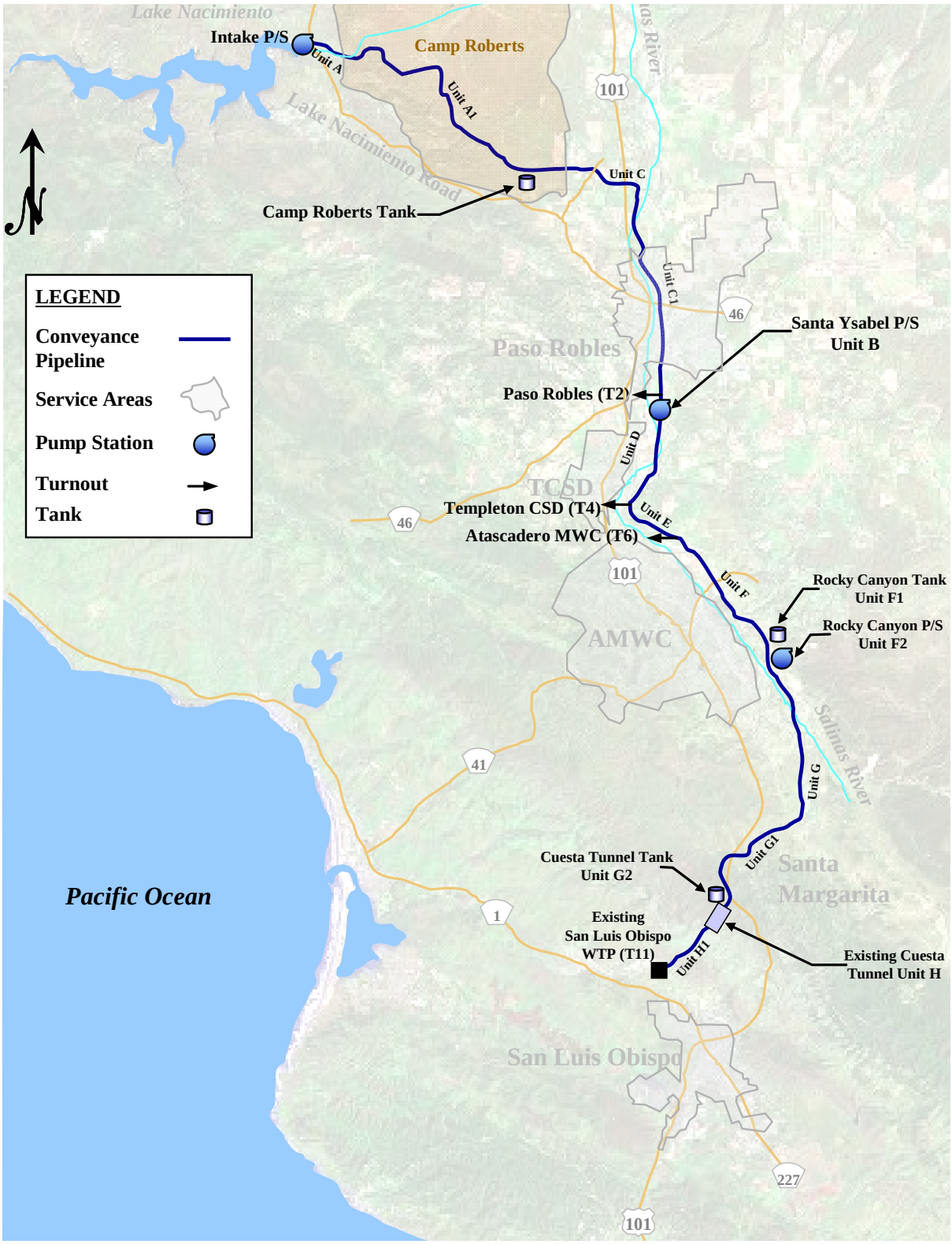
110.3.1 UNIT DESCRIPTIONS

Water Delivery Entitlement Contracts were negotiated and signed with four Initial Participants: Paso Robles, AMWC, TCSD and SLO. The Contracts define 19 Project "units", or operating segments. These are shown on Figure 110-1 and summarized in Table 110-2.

Table 110-2: Overview of Project Units

Unit	Description	Remarks
A	Lake Nacimiento IPS to Camp Roberts West Property Line	Raw water intake, pump station, and pipeline.
A1	Camp Roberts West Property Line to and Including the CRT	Pipeline, CRT, and associated facilities.
B	SYPS	Connection to conveyance pipeline, suction and discharge pipe, pump station, and associated facilities.
C	CRT Outlet to Monterey Rd / Wellsona	Pipeline from CRT to intersection of Old Highway (Hwy) 101 and Monterey Road, including highway crossing.
C1	Monterey Rd / Wellsona to Paso Robles Turnout	Pipeline from intersection to mainline connection for Paso Robles Turnout, including a Salinas River crossing.
D	Paso Robles Turnout to TCSD Turnout, excluding the SYPS (Unit B)	Pipeline including surge control facilities, microtunneling through Santa Ysabel Ranch, road crossing, and other facilities.
E	TCSD Turnout to AMWC Turnout	Pipeline including road crossings and other facilities.
F	AMWC Turnout to RCT Inlet	Pipeline to connection with inlet of RCT.
F1	RCT	Tank and suction connection to RCPS.
F2	RCPS	Pump station, discharge pipe, and connection to pipeline.
G	RCPS Discharge to Route 58/Maria Avenue	Pipeline to Route 58/Maria Avenue intersection including a Salinas River crossing.
G1	Route 58/Maria Avenue to CTT Inlet	Pipeline to inlet of to CTT including railroad and roadway crossing.
G2	CTT	Tank and pipeline to the north portal flange of the existing Cuesta Tunnel Pipeline.
H	Cuesta Tunnel	Existing Nacimiento Pipeline in tunnel from existing north portal inlet flange through south portal outlet flange.
H1	Cuesta Tunnel to SLO/CSA10A Turnout	Pipeline from south portal outlet in tunnel to WTP including railroad and road crossings.
T2	Paso Robles Turnout	Turnout to Paso Robles.
T4	TCSD Turnout	Turnout to TCSD.
T6	AMWC Turnout	Turnout to AMWC.
T11	SLO/CSA10A Turnout	Turnout to SLO/CSA10A.

Figure 110-1: NWP Unit Map



Detailed Unit descriptions are included in Chapter 140: Unit Descriptions, System Maps and Schematics.

110.4 PARTICIPANTS AND WATER DELIVERY CONTRACTS

The District has a 17,500 AFY entitlement from the Nacimiento Reservoir. Of this, 15,750 AFY is slated to be transported to the North and South County purveyors. The remaining 1,750 AFY is reserved for local lakeside uses. The Project is designed to convey the District's full entitlement less the lakeside set aside, equaling 15,750 AFY. This will facilitate responding to the present and future needs of the Initial Participants identified above and including additional participants in the future as feasible.

Article 6 of the Entitlement Contracts specifies the maximum instantaneous rate of flow to be delivered by the District to each Initial Participant, as well as the maximum amount of water to be delivered in any one month. Tables 110-3 and 110-4 provide details.

Table 110-3: Delivery Entitlements – Original Contracts (1)

Participant	Total Amount Each Water Year (AF)	Max. Instantaneous Rate of Flow (cfs)	Max. Amount In Any One Month (AF)
Paso Robles	4,000	6.10	367
TCSD	250	0.38	23
AMWC	2,000	3.00	183
SLO	3,380	5.10	310
Subtotal	**9,630**	**14.58**	**883**
Reserve Capacity	6,120	9.30	562
Total	**15,750**	**23.88**	**1,445**

(1) Source: Water Delivery Entitlement Contracts, August 17, 2004, with peaking factor of 1.1.

Table 110-4: Delivery Entitlements – Per Updated Contracts (2)

Participant	Total Amount Each Water Year (AF)	Max. Instantaneous Rate of Flow (cfs)	Max. Amount In Any One Month (AF)
Paso Robles	4,000	9.03	537
TCSD	250	1.03	63
AMWC	2,000	8.29	500
SLO	3,380	5.10	310
CSA10A	25	0.04	2.3
Subtotal	**9,655**	**23.49**	**1,412.3**
Reserve Capacity	6,095	9.30	558.7
Total	**15,750**	**32.79**	**1,971**

(2) Subject to revision of existing Water Delivery Entitlement Contracts to conform to current design flows.

110.5 PROJECT TEAM

Fig. 110-2 is an organization chart listing all responsible agencies for implementation of the Project during design and construction:

Figure 110-2: Project Organization during Design and Construction

Click Here For Figure 110-2

110.6 SUMMARY OF NWP CONTRACTS

For competitive bidding and more efficient construction management, the NWP was split into five construction contracts, details of which are summarized in Table 110-5.

Table 110-5: Details of Construction Contracts

Contract Name	Contract Details	Contractor	Contract Value, Bid / Final Million $	Contract Duration, Bid / Actual
Spec 01 - Intake	Unit A Intake Facility complete with 20 ft diameter Intake Shaft 52 in. inside diameter Intake tunnel 48 in. diameter Intake Pipe complete with seven Intake Ports, Screens, Isolation valves, actuators, HPU and all interconnecting piping	J.W.Fowler, 12775 Westview Drive, Dallas, OR 97338 Ph: (503) 623 5373	20.81 / 21.84	Oct 2007 to Jan 2009 / Oct 2007 to Nov 2009
Spec 02 - NWP Facilities	All Civil, Architectural, Structural, Mechanical, Electrical, Instrumentation and Controls, HVAC & Plumbing and Irrigation and Landscaping works associated with Unit A - Intake Pump Station Unit A1 - Camp Roberts Tank Unit B - Santa Ysabel Pump Station Unit F1 - Rocky Canyon Tank Unit F2 - Rocky Canyon Pump Station Unit G2 - Cuesta Tunnel Tank Spec 02 is responsible for overall SCADA integration and start up of the entire NWP systems, including turnouts T2, T4, T6 and T11.	Mountain Cascade Inc., 555 Exchange Ct, Livermore CA 94550 Ph: (925) 373 8370	25.59 / TBD(3)	Oct 2007 to Nov 2010 / TBD
Spec 03- Pipeline North	All of the pipelines and related appurtenances and Fiber Optic System along the pipeline for Units A, A1, C and C1	Teichert Construction Inc. 4533 E. Citron Ave, Fresno CA 93725 Ph: (559) 813 3100	38.36 / TBD	Oct 2007 to Mar 2010 / TBD
Spec 04- Pipeline Central	All of the pipelines and related appurtenances and Fiber Optic System along the pipeline for Units D, E, F, T2, T4 and T6	Whitaker Contractors Inc., 2752 Concrete Court Paso Robles CA 93446 Ph: (805) 226 4020	22.70 / 22.89	Oct 2007 to Oct 2009 / Oct 2007 to Sep 2009

Contract Name	Contract Details	Contractor	Contract Value, Bid / Final Million $	Contract Duration, Bid / Actual
Spec 05 - Pipeline South	All of the pipelines and related appurtenances and Fiber Optic System along the pipeline for units G, G1, H, H1 and T11	Southern California Pipeline Construction Inc. 15991 Redhill Ave #200 Tustin CA 92780 Ph: (714) 838 3079	16.33 / TBD	Oct 2007 to Nov 2009 / TBD
	Total		**123.78 / TBD**	

(3) TBD – To be determined

110.7 SAFETY AND PROTECTION

The District will be responsible for implementing the safety and protection requirements associated with operation and maintenance of the Project. The District has created a Safety Plan for such purpose that summarizes all safety precautions and program requirements. A summary of the District's Safety Plan is presented in Section 335.

The District will designate a qualified and experienced safety representative whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and the safety program. All operations and maintenance personnel shall comply with the requirements of the Safety Plan and associated directives.

APPENDIX 3-5E – LETTERS OF SUPPORT

Mark S. Ghilarducci, Director
California Governor's
Office of Emergency Services
3650 Schriever Ave.
Mather, CA 95655

Ron Alsop, Manager
Emergency Services Manager
County of San Luis Obispo
Office of Emergency Services
1055 Monterey St., Ste. D430
San Luis Obispo, CA 93408

July 21, 2014

Dear Office of Emergency Services:

The undersigned State and local agencies have developed and executed this joint Letter of Support to inform you of our current joint efforts in addressing the impacts of California's drought. More specifically, we are working jointly in addressing the drought as the agencies below are co-located in a complex of government institutions which receives water from the California Men's Colony (CMC) Water Treatment Plant (WTP).

State Agencies:

- California Department of Corrections and Rehabilitation (CDCR)
- Cal Fire
- California Men's Colony (CMC)
- Camp San Luis Obispo, California National Guard
- CAL OES
- California Specialized Training Institute
- San Luis Obispo County Office of Emergency Services and other County Facilities
- San Luis Obispo Sheriff's Office - County Jail
- Cuesta Community College
- San Luis Obispo County Office of Education

Although these institutions are currently implementing the Governor's water usage reduction order (there has also been an 18% reduction since 2006), if State Water deliveries are severely curtailed or not delivered, the impact will be unprecedented. State Water accounts for 80% of the water used by these agencies. CMC currently has a small supply of local carry over water in a local reservoir; however interconnections to other local water sources are critical in meeting water needs for 2015 and beyond.

To that extent, the County of San Luis Obispo is pursuing grants to construct an intertie to the Salinas Reservoir Pipeline and extend the pipeline to the CMC WTP. Parallel work efforts may include:

1. Evaluation of CMC WTP and capability to treat a new source of water and meet any additional regulatory requirements.
2. Evaluation of CMC WTP capacity to determine how interties might also help other local agencies distressed during the drought.
3. Long-term system management issues, including, but not limited to:
   - Geographical Informational Systems mapping
   - Environmental impacts

- Water treatment practices
- Development of a Joint Powers Agreement for long term water operations

The aforementioned State and local agencies are working cooperatively in order to address long-term operational issues to improve each agency's individual water resource situation, as well as a combined situation for the entire water system. At this time, our primary purpose is to respond to Governor Brown's Proclamation of a Drought Emergency and demonstrate the need for emergency funding. Attached is the project description for the Salinas Reservoir Pipeline to CMC WTP.

Sincerely,

Bruce S. Gibson, Chair
County of San Luis Obispo
Board of Supervisors

4 Valenzuela, CDW

Elvin Valenzuela, Warden
California Men's Colony

Ian Parkinson, Sheriff
County of San Luis Obispo

Joseph D. Righello, Colonel (CA)
Commander, Camp San Luis Obispo, California Army National Guard

Chief Robert Lewin,
Cal Fire, San Luis Obispo Unit

Dr. Julian D. Crocker, County Superintendent of Schools
San Luis Obispo County Office of Education

Dave Flynn

Dave Flynn, Interim Public Works Director
County of San Luis Obispo

PROJECT DESCRIPTION AND NEED

DESCRIPTION:

Project will consist of construction of an intertie between the Salinas Reservoir Pipeline and the Nacimiento Reservoir Pipeline. Project will also consist of the extension of the Salinas Reservoir Pipeline to the California Men's Colony Water Treatment Plant approximately 0.8 miles downstream from the terminus of the existing Salinas Reservoir Pipeline in order to avoid creek habitat. Depending on the condition of the existing Salinas Pipeline, the Project may also include rehabilitation or replacement of all or portions of the existing Salinas Pipeline from the existing terminus to a demarcation point approximately 1.1 miles upstream.

PURPOSE/NEED:

The purpose of the Project is to provide for transfer of Nacimiento Reservoir water (6,095 AF of reserve water available) to the Salinas Reservoir Pipeline for distribution to downstream users via the California Men's Colony Water Treatment Plant and distribution system. The need for the Project is to provide another source of water to the California Men's Colony and other downstream users should their primary resource become unavailable. Several of the downstream users rely solely on State Water, with approximately 1,000 AF delivered per year. Currently, State Water allocations are at a 0% delivery year and State Water "carry-over water" entitlements have been restricted. Stored water may become unavailable or exhausted in late 2014 or early 2015.

The institutions are preparing for a worse-case scenario where zero deliveries of any State Water occur in 2015. Access to the 6,095 AF would provide a secure source of water until precipitation returns and water resources can be replenished.