Prepared for

PG&E

and the
State Water Resources Control Board
Nuclear Review Committee

Independent Third-Party Interim Technical Assessment

for the

Source Water Substrate Filtering Collection System for Diablo Canyon Power Plant

Prepared by BECHTEL Bechtel Power Corporation

Report No. 25762-000-30R-G01G-00007 Rev. 0

July 22, 2012

Independent Third-Party Interim Technical Assessment

for the

Source Water Substrate Filtering Collection System for Diablo Canyon Power Plant

Prepared by:

Bechtel Power Corporation

Revision	Date	Affected Sections
0	July 22, 2012	Initial Issue

Contents

List of Tables

List of Figures

List of Abbreviations and Acronyms

agl	above ground level
APCD	(San Diego) Air Pollution Control District
ATC	Air Pollution Control District Authority to Construct
BLM	Bureau of Land Management
Caltrans	California Department of Transportation
CCRWTQCG	Coastal Commission Regional Water Quality Control Board
CDFG	California Department of Fish & Game
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPUC	California Public Utility Commission
DCPP	Diablo Canyon Power Plant
EPCRA	Emergency Planning and Community Right-To-Know Act
FAA	Federal Aviation Administration
fps	foot per second
gpm	gallons per minute
GWA	Government of Western Australia
mgd	million gallons per day
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
OHP	Office of Historic Preservation
PG&E	Pacific Gas and Electric
PTO	Air Pollution Control District Permit to Operate
RC	Resource Commission
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
SPCC	Spill Prevention Control and Countermeasure Plan
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Council Board
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USMC	U.S. Marine Corps
WDR	Waste Discharge Requirement

Independent Third-Party Interim Technical Assessment
for the Deepwater Offshore Intake for
Diablo Canyon Power Plant
Report No. 25762-000-30R-G01G-00007

1. Executive Summary

The primary objective of implementing the source water substrate filtering collection system technology into the Diablo Canyon Power Plant (DCPP) once-through cooling system is that this technology offers the possibility of substantially reducing the entrainment of aquatic species at different stages of life (including fish, fish egg and larvae) and reducing impingement mortality.

The source water substrate filtering collection system technology screens egg/larvae and juvenile/adult fish from entering the system by a combination of filtration through bottom sediments/filters and low through-sediment velocities. The design velocity is not expected to exceed 0.5 feet per second (fps) and so meets the Track 1 impingement criterion associated with Section 316(b), *California Once-Through Cooling Policy*. Even though the total volumetric flow withdrawal will be the same, the substrate filtration and very low withdrawal velocities will result in significantly less fish egg/larvae entrainment relative to the existing system.

Permitting is expected to be contentious and have lengthy processes that will be aligned with the California Environmental Quality Act (CEQA)/Environmental Impact Report review process, even if this technology goes ahead. The primary difficulty appears to be that the substrate filtering intake system poses significant construction impacts to marine habitats, while offering clear impingement and entrainment related benefits. Despite this system's inability to meet the flow reduction requirements expressed in Section 316(b), *California Once-Through Cooling Policy* performance criteria, the consistent message from all of the interested regulatory agencies was that there were no environmental impact issues or criteria that would preclude this technology option from securing the necessary construction and operating permits and approvals. That is, there were no fatal flaws in the associated regulatory review process that would preclude the substrate filtering intake system from further consideration.

This study concludes that the use of the source water substrate filtering collection system technology is a first of kind and an unconventional intake design for large once-through cooling systems such as DCPP. This technology is used, if at all, as a makeup source for cooling towers where the flow is a small fraction of once-through cooling flow. Our preliminary evaluations have shown that to accommodate the flow rates required the lateral grid system would require between 26 acres and 787 acres depending on the use of artificial or natural substrate material, assuming a 100 percent efficiency can be maintained over the life of the plant. These substrate areas are indeed very large. If the design efficiency is less than 100 percent, say 50 percent or 25 percent, the required substrate area will be two and four times larger..

Consequently, this option should not be a candidate for further evaluation in the next phase of the assessment.

Criterion	Status
External Approval and Permitting	No fatal flaws
Impingement/Entrainment Design	No fatal flaws
Environmental Offsets	No fatal flaws
First-of-Kind to Scale	Fatal flaw - The use of this technology for a water supply system of this size has not been used and is impractical
Operability of General Site Conditions	Low reliability and ever decreasing lateral efficiency makes this technology a fatal flaw.
Seismic and Tsunami Issues	No fatal flaws
Structure and Construction	No fatal flaws.
Maintenance	No practical maintenance program causes it to be a fatal flaw.
Conclusion	Technology is not a candidate for Phase 2 review

2. Background and Introduction

2.1 Purpose/Scope of Study

This study is performed in accordance with the requirement established by the State Water Resources Control Board (SWRCB) for Pacific Gas & Electric to conduct a detailed evaluation to assess compliance alternatives to once-through cooling for the DCPP. This requirement is associated with the *California Statewide Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling*, which established uniform, technology-based standards to implement the Clean Water Act Section 316(b) that mandates that location, design, construction, and capacity of the cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts.

This report describes the detailed evaluation of source water substrate filtering collection system technology for DCPP based on the list of site specific criteria approved by the Nuclear Review Committee. The evaluation process includes critical review of published data and literature, consultation with permitting agencies and technical assessment supported by engineering experience and judgment. No new field data was collected as part of this effort. The results of the evaluation are used to characterize the feasibility of this technology and its possible selection as a candidate for further investigation in a follow-on phase of this study.

2.2 Regulatory History

2.2.1 Federal

The U.S. Environmental Protection Agency (USEPA) has proposed standards to meet its obligations under the Section 316(b) of the Clean Water Act to issue cooling water intake safeguards. Specifically, this section requires that National Pollutant Discharge Elimination System (NPDES) permits for facilities with cooling water intake structures ensure that the location, design, construction, and capacity of the structures reflect the best technology available to minimize the harmful impacts on the environment. These impacts are associated with the significant withdrawal of cooling water by industrial facilities, which remove or otherwise impact significant quantities of aquatic organisms from the waters of the United States. Most of the impacts are to early life stages of fish and shell fish through impingement and entrainment. Impingement occurs when fish and other aquatic life are trapped against the screens when cooling water is withdrawn resulting in injury and

often death. Entrainment occurs when these organisms are drawn into the facility where they are exposed to high temperatures and pressures—again, resulting in injury and death. (USEPA, 2011)

In response to a consent decree with environmental organizations, the USEPA divided the Section 316(b) rules into three phases. Most new facilities (including power plants) addressed in the Phase I rules, initially promulgated in December 2001. Existing power plants were subsequently addressed, along with other industrial facilities, in the Phase II version of the rules, issued in February 2004. Since then the rule has been challenged, remanded, suspended, and re-proposed. The current proposed version of the rule dictates that all existing facilities that withdraw more than 2 million gallons per day (mgd) of water from waters of the U.S. and use at least 25 percent of the water they withdraw exclusively for cooling purposes would be subject to:

- Upper limit on the number of fish killed because of impingement and determining the technology necessary to comply with this limit, or
- Reduce the intake velocity to 0.5 feet/second (through-screen) or below, which would allow most fish to avoid impingement.

Large power plants (water withdraw rates 125 mgd or greater) would also be required to conduct a studies to help their local permitting authorities (SWRCB) to determine site specific best technology available for entrainment mortality control. Note this version abandoned the original performance standards approach, which mandated the calculation of baseline against which reduction in entrainment and impingement can be measured.

The Section 316(b) Phase II final rule is expected to be issued on July 27, 2012. When the final rule become effective it is likely to include an implementation timeline, which would drive the implementation of technologies to address the impingement requirements within 8 years (2020).

2.2.2 State

The SWRCB is responsible for ensuring compliance with the finalized Section 316(b) rules in California and it has been actively pursuing a parallel path regulatory program that is focused on the state's coastal generating stations with once-through cooling systems including DCPP. The SWRCB's *Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Once-Through Cooling) Policy* became effective on October 2, 2010. This Policy established statewide technology-based requirements to significantly reduce the adverse impacts to aquatic life from once-through cooling. Closed-cycle wet cooling has been selected as best technology available.

Affected facilities, including DCPP, are expected to:

- Reduce intake flow to a level commensurate with that attainable with a closed-cycle wet cooling system and reduce through-screen velocity to 0.5 feet/second or below—Track 1, or
- Reduce impacts to aquatic life comparably by other means – Track 2

This policy is being implemented through a so-called *adaptive management strategy*, which is intended to achieve compliance with the policy standards without disrupting the critical needs of the state's electrical generation and transmission system. A Nuclear Review Board was later established to oversee the studies, which will investigate the ability, alternatives, and costs for both SONGS and DCPP to meet the policy re-

quirements. This study is a direct outgrowth of that adaptive management strategy to implement this (Once-Through Cooling) (Bishop, 2011).

Current Cooling Water Intake System and Section 316(b) Compliance History

DCPP operates a single cooling water intake structure to provide cooling water to Units 1 and 2. Each unit's water withdrawal rate is nominally 867,000 gpm or 1,248 million gallons a day (mgd). Cooling water is withdrawn through a shoreline intake structure in a cove partially protected with man-made breakwaters. The inlet structure includes a set of inclined bar racks and traveling screens. A concrete curtain wall extends 7.75 feet below mean sea level to keep out floating debris. Incoming cooling water for the normal circulating water system travels to one of four separate screen bays (two per unit). Each screen bay is fitted with three rotating vertical traveling screen assemblies with 3/8-inch stainless steel mesh panels. The through screen velocity is approximately 1.95 fps. A high-pressure spray wash removes any debris or fish that have become impinged on the screen face into a sump, which leads back to the intake cove (Enercon, 2009). In addition, each unit has two auxiliary saltwater trains (one duty and one standby) that perform safety-related functions and each train is served with one auxiliary saltwater pump, rated at 11,000 gpm (DCPP, 2009). The auxiliary saltwater pumps for each unit are housed in separate pump bays located near the center of the intake structure, and are serviced by a common 5-feet wide traveling water screen.

This cooling water intake structure is not viewed as having technologies, which are effective at reducing impingement mortality and entrainment losses. Consequently, this matter has been the subject of a number of Coastal Commission Regional Water Quality Control Board (CCRWQCB) initiatives, which have increasingly focused attention on mitigation of impingement and entrainment impacts via application of potentially viable alternative cooling system technologies.

2.3 Screening Process (A/B Criteria)

The technology screening process for the Phase I portion of the evaluation will be performed using a Criteria Set A/B approach that achieves a technically comprehensive assessment while concurrently minimizing the time and effort required. The screening will be initially performed for Set A criteria. If the technology satisfies all of the Set A criteria, it will be evaluated using Set B criteria.

Set A criteria include the following items that are judged to be critical to the screening process:

- External approval and permitting (nonnuclear licensing)
- Impingement/entrainment design
- offsetting environmental impacts

All remaining criteria are grouped into Set B criteria, which are shown below:

- First-of-a-kind to scale
- Operability general site conditions
- Seismic and tsunami issues
- Structural
- Construction
- Maintenance

During the screening process, if any criterion cannot be met, the screening process is suspended, and a summary report for that technology is then prepared.

3. Technology Description

3.1 Introduction

The source water substrate filtering collection system, also referred to as an infiltration intake, is an unconventional intake design and that, to our knowledge, has not been applied to such a large once-through cooling system. It has been used, however, for cooling tower makeup water systems, with intake flow rates that are typically a fraction of the once-through cooling flow rates. A typical arrangement of this type of intake consists of a set of horizontal laterals constructed of perforated or slotted pipe that are placed below the seafloor in a bed of porous media. The laterals are connected via a manifold to a pump intake forebay that is part of the cooling water system.

The advantages of the substrate filtering collection system include following:

- It can be applied to shallow water near the shoreline.
- The flow capacity is relatively unaffected by tidal influences.
- The turbidity of the produced water is low and relatively constant.
- Entrainment and impingement of aquatic organisms and debris are eliminated.

However, the disadvantages are:

- Clogging of porous media (filtered media such as gravel or sand) due to vegetation growth, silt/clay and bio-growth, can lead to reduced or stopped flow to the connecting manifolds after certain period of operation.

- With horizontal laterals buried under the sea bottom, it is difficult to know whether a lateral is flowing with water or clogged.

- For a vast field of laterals for a once-through cooling application, the vast number of laterals may make the maintenance cleaning using hydraulic jet or brushes not practical.

- From day one of the operation, the available efficiency of laterals is only decreasing. There is no assurance if the remaining efficiency of laterals can maintain adequate flow after a period of operation, which could lead to forced plant shutdown.

3.2 Conceptual Design

Two configurations of the substrate filtering collection system have been considered for this evaluation: the natural (beach) filter system and the artificial (beach + filter) filter system. The natural substrate filter system uses the native substrate (that is, offshore deposits of beach sand or gravel) as backfill around the horizontal laterals. The artificial substrate filter system uses an engineered filter media (that is, clean sand or gravel) to replace the native substrate around the horizontal laterals to enhance seawater infiltration. Figure SWS-1 presents a general conceptual layout and Figures SWS-2 and SWS-3 illustrate the two configurations.

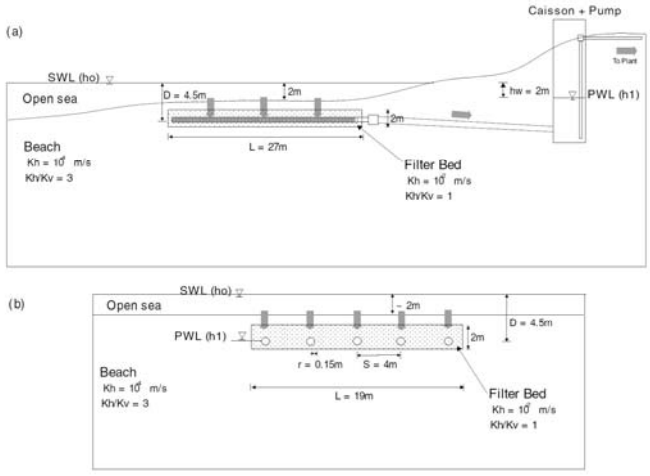


Figure SWS-1. *Conceptual Layout of a Typical Substrate Filtering Collection System (Taylor and Headland, 2005)*

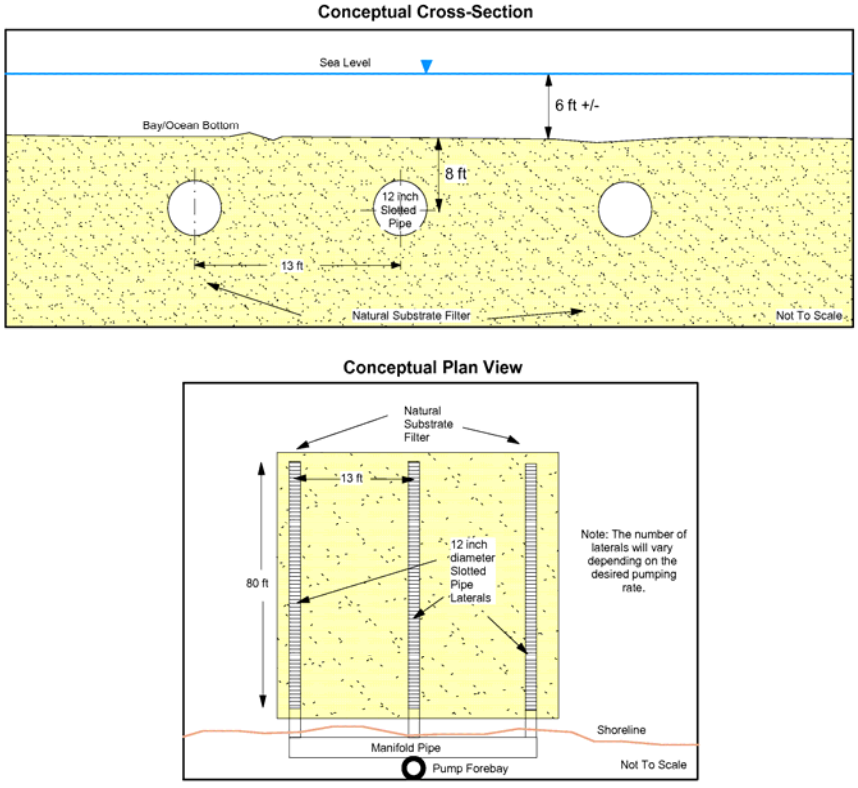


Figure SWS-2*. Natural Substrate (Beach) Filtering Collection System Conceptual Design*

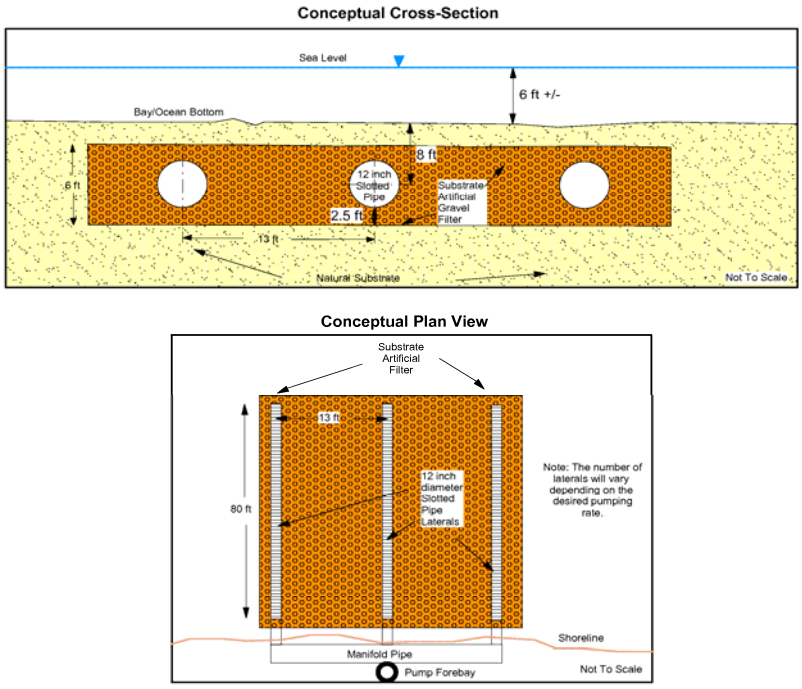


Figure SWS-3.
Artificial Substrate (Beach + Filter) Filtering Collection System Conceptual Design

The natural filter system is used in area where the natural substrate (offshore deposits of sand and gravel) has the desired material properties (hydraulic conductivity) for the required flow to filter through the substrate at a reasonable rate. This serves to limit the need to increase the laterals area. The artificial filter system is useful in areas where the natural substrate (offshore deposits) has lower hydraulic conductivity (reduced flow velocity) because of its fine particles (silts and clays) in the material. In this case, the natural substrate is removed and an artificial filter of sand or gravel is placed as backfill over the horizontal laterals. This increases the local flow velocities, thereby minimizing the areal extent of laterals. The permeability of the substrate, both natural and artificial, along with the design inflow rate for the cooling system is the primary factor that determines the number of required laterals.

To evaluate the engineering requirements for the implementation of this technology, the hydraulic design criteria developed by Taylor and Headland (2005) for the substrate filtering collection system conceptual design using a variety of substrate and artificial filter parameters are adopted. These parameters include the horizontal hydraulic conductivity of the substrate (K_h), the vertical anisotropy ratio (ratio of horizontal to vertical hydraulic conductivity K_h/K_v) of the substrate, lateral length (L), lateral burial depth, lateral spacing (S), lateral radius (r), and head difference across the system (dh) as shown in Figure D7.1. These parameters were used with a groundwater model to develop a family of design charts for various pumping rates, horizontal hydraulic conductivities, vertical anisotropy ratios, and head differences (Taylor and Headland, 2005). Figures D7.4 and D7.5 show the charts for an anisotropy ratio of 10 (horizontal hydraulic conductivity is 10 times the vertical hydraulic conductivity), which is typical of natural materials. It should be noted that the anisotropy ratio of the artificial filter is maintained at one (horizontal and vertical hydraulic conductivities are

the same) with a fixed horizontal hydraulic conductivity of 1 x 10^{-2} m/s (2800 ft/d) that is typical of coarse gravel. For the artificial filter deign, the hydraulic properties of both the engineered filter media and that of the surrounding natural substrate are considered in the design.

3.3 Design Considerations

The design considerations for the substrate filtering collection system include the following:

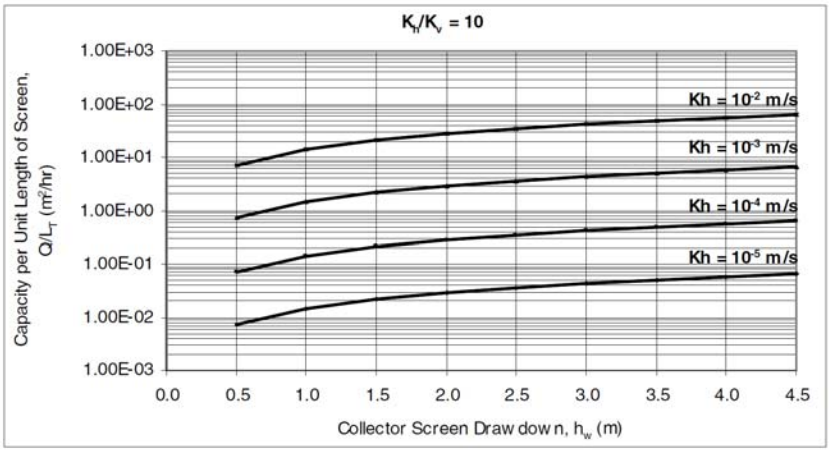
- Site-specific hydraulic conductivity testing for the substrate will be required.
- Substrate is not suitable for shallow (less than 10 feet) bedrock areas due to excavation difficulty, however there are other excavation technologies, such as horizontal drilling, which can support installation :
- Additional permitting for spoils disposal associated with the artificial filter system will be required.:
- Substrate installation may require custom marine excavating equipment depending upon site conditions,
- The local availability of material for artificial filter system may be a concern:
- Substrate installation may require a long-term prevention and maintenance program to limit vegetation growing over the substrate filtering collection system that could lead to a reduction in the permeability of the sea floor material above the laterals area.
- Suction piping network connecting various offshore horizontal laterals to the shoreline pump intake, with the intake cove opening closed out. The high head differential across the system will likely require the addition of a new pump forebay connected to a suction pipeline so that the cooling water pumps can have sufficient submergence and NPSH for continuous reliable operation.

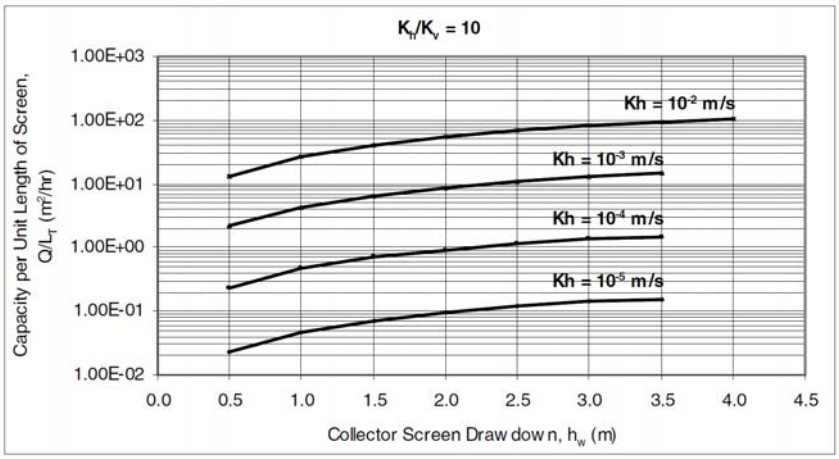
3.4 DCPP Conceptual Design Assumptions

The following assumptions are used in the DCPP conceptual design:

Parameter	English Units	Metric Units
Flow Demand (Q_d)	1,753,000 gpm	398,106 m^3/hr
Horizontal hydraulic conductivity (K_h)	28 to 280 ft/d	1 x 10^{-4} to 1 x 10^{-3} m/s
Anisotropy Ratio (K_h/K_v)	10	10
Lateral length (L)	80 ft	25 m
Lateral spacing (S)	13 ft	4 m
Lateral area (L×S)	1,040 ft^2	100 m^2
Head difference across system (h_w)	11.5 ft	3.5 m

The range of horizontal hydraulic conductivities selected represents typical values for beach sands. Using the charts on Figures SWS-4 and SWS-5, the resulting infiltration area needed to produce the required flow are listed in the table below:





K_h/K_v = 10 (anisotropy ratio)
Artificial Substrate Filtering Collection System
After Taylor and Headland, 2005

K_h values shown on the chart are for the substrate, K_h of artificial filter = 1 x 10^{-2} m/s with a K_h/K_v = 1

Figure SWS-5. *Conceptual Design Chart for Artificial Substrate Filtering Collection System*

Intake Type	Horizontal hydraulic conductivity of substrate K_h (m/s)	Flow per unit length of lateral Q/L_T (m^2/hr)	Total length of lateral $Q_d/(Q/L_T) = L_\Sigma$ (m)	Number of laterals needed - N $L_\Sigma/25$ (m)	Infiltration area N x 100 m^2 (m^2)	Infiltration area (acres)
Natural	1 x 10^{-4}	0.5	796,200	31,850	3,185,000	787
Natural	1 x 10^{-3}	5	79,620	3,185	318,500	79
Artificial*	1 x 10^{-4}	1.5	265,400	10,600	1,061,600	262
Artificial*	1 x 10^{-3}	15	26,540	1,060	106,160	26

*Artificial filter consists of coarse gravel with a K_h = 1 x 10^{-2} m/s and an anisotropy ratio of 1

To develop the type curves shown in Figure SWS-5, the horizontal hydraulic conductivity of the artificial filter bed surrounding the laterals (shown in Figure SWS-3) are kept at a constant value of 1 x 10^{-2} m/s with anisotropy of 1 (that is horizontal and vertical hydraulic conductivity of the artificial filer bed to be equal). Whereas, the natural substrate filter was varied to develop the type curves in Figure SWS-5. Based on the preliminary sensitivity analyses using the type curves presented in Taylor and Headland (2005), the area required for the substrate filtration collection system would range from 26 acres (106,160 m^2) to 787 acres (3,185,000 m^2) depending upon the actual substrate horizontal hydraulic conductivity and whether the artificial or natural filtration system is used. This, however, is based on a 100 percent efficiency.

Figure SWS-6 presents a conceptual location of the area where the substrate filtration collection system may be located. The preliminary location is close to a mile away from the rocky shoreline (assuming the substrate close to the shoreline to be rocky and assuming the potential area for the substrate laterals to have unstratified sand and gravel). The locations are preliminary and the layout of the laterals has not been specifically delineated. The final locations and geometry of the actual size can be determined after the required site-specific tests and studies (geologic, hydrogeologic, and geophysical) are performed.

Figure SWS-6, shows the upper bound of the areas needed for lateral placement when using natural substrate material (787 acres) and artificial substrate material (262 acres). These areas are based on the assumption that the substrate laterals are 100 percent efficient and that the differential head and other design parameters remain constant. However, the efficiency of the laterals could be less (due to potential plugging of the laterals over time) resulting in the need for a greater number of laterals and the associated increase in offshore impacts. If it is assumed that the laterals are 50 percent efficient over the operational life of the plant, then the size of the area and the laterals will be two (2) times greater than the initial estimates presented earlier. This initial estimate is also based on the assumption that the flow across the laterals is uniform and the head in the laterals does not vary along the length. The flows and heads across the laterals, however, could be nonlinear, which results in dynamic head differential while pumping from a caisson, and the need for additional laterals to account for the reduction in efficiency. In addition, flow balancing to each horizontal lateral will be difficult due to a large network of manifolds fan out to receive flow from laterals and then converge to a central pump forebay. This condition will result in laterals located far away from the main manifold/piping to receive less flow than laterals closer to the main manifold/piping, which can ultimately cause flow stoppage through those laterals, reducing overall efficiency of the substrate intake system.

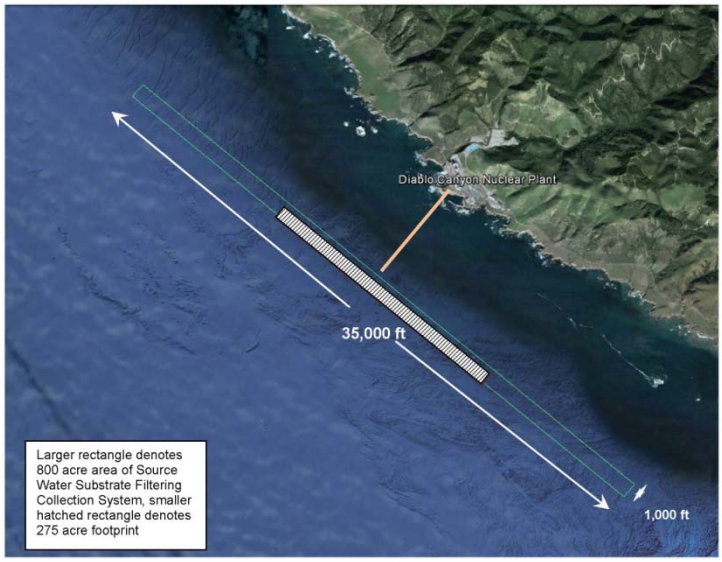


Figure SWS-6. *Conceptual Layout of Source Water Substrate Filtering Collection System at DCPP*

Note: Figure SWS-6 is a conceptual representation of a Substrate Filtering Collection System. Actual location and areal extent of the system may be different than that presented. Multiple design approaches are possible than that of the rectangle area shown in the figure; dependant on the offshore conditions at DCPP and regulatory requirements.

The seafloor sediment conditions at DCPP may not be conducive to the installation of this type of system. Harrison (1987), summarizing Lillevang's Basin Intake Report states that sea floor "is a confused jumble of holes, pinnacles, trenches and short, wall-line formations of the harder strata in the steeply tilted formation." Thus excavation for the laterals may be difficult in this terrain. In addition, occurrence of submarine landslides and vegetation growth should be further investigated to determine the feasibility of implementing this technology at DCPP.

4. Criterion Evaluation

4.1 External Approval and Permitting – Substrate Filtering Intake System

4.1.1 General Discussion

The external approval and permitting assessment focused on identifying the applicable (required) permits and approvals for construction and operation of a substrate filtering intake system.

The initial assessment effort focused on developing a comprehensive list of potentially applicable permits and approvals at the federal, California, county, and municipal level (as applicable). This applicability of each permit/approval to the proposed substrate filtering intake option was evaluated. Those permits and approvals that were deemed applicable were subsequently scrutinized to characterize the expected duration and complexity of the regulatory review process. Special attention was directed to identifying environmental im-

pact issues or criteria that would preclude the applicable permit or approval from ever being issued or granted. That is, the focus was to screen each applicable permit or approval for fatal flaws in the associated regulatory review process that would preclude the substrate filtering intake system from further consideration.

The assessment also focused on identifying the critical path (longest duration) initial preconstruction permitting processes, that is, those that support site mobilization, physical site access, initial earthwork/ foundations for each cooling system technology option. The duration of the permitting and the approval process, while not a definitive fatal flaw, could later serve as a screening tool if combined with specific schedule limitations.

Permits and approvals that support later stages of construction and operation, which are not critical path to the commencement of construction were also included in the assessment since these items could pose significant operational constraints to future DCPP operations.

4.1.2 Detailed evaluation

This summary list of permits provided the basis for subsequent discussions with key relevant regulatory authorities regarding the applicable permit application needs and the permit review time frames. These discussions were also critical for the identification of potential regulatory or permit-related barriers to implementation—fatal flaws.

The following regulatory authorities were contacted:

- U.S. Army Corps of Engineers (USACE)
- California Public Utility Commission (CPUC)
- California Coastal Commission (CCC)
- California State Lands Commission
- State Water Resources Control Board (SWRCB)
- Central Coast Regional Water Quality Control Board (CCRWQCB)
- San Luis Obispo Air Pollution Control District (APCD)
- San Luis Obispo County

The following sections discuss the relevant key permitting/approval processes for each cooling technology and summarize these findings in Table SWS-1. This table lists the applicable permits and approvals, determines the critical path review processes and most importantly, highlights those processes that may be fatally flawed.

4.1.2.1 Substrate Filtering Intake System

This substrate filtering intake system is essentially an infiltration seawater intake system or more correctly, a substrate filtering/collection system. This system includes a set of horizontal laterals constructed of perforated or slotted pipe placed below the seafloor in a bed of porous media. The laterals are connected via a manifold to a pump intake forebay for pumping. The seabed acts as the filter for this system. The offshore foot print needed to accommodate this substrate collection system is very significant.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) is the lead agency for Clean Water Act Section 404 and Section 10 permitting processes, which are focused primarily on impacts to waters of the United States and wa-

terborne navigation. The substrate filtering intake system will involve offshore cut and fill or tunneling (turbine boring machine) processes, which will pose significant construction impacts to USACE jurisdictional waters.

For minor impacts the USACE has established a general permit program (nationwide permit) for a host of less significant work processes involving waters of the United States. The significant marine work associated with this cooling system option precludes any nationwide permit permitting process for cut/fill and tunneling construction options. DCPP, therefore, would then be faced with securing the more complex individual Section 404/10 permit.

While Section 404 permit review periods can often be lengthy, the USACE representative for the DCPP area explained that all USACE facilities have goal to issue an individual Section 404 permit within 120 days of deeming the associated application complete (Lambert, 2012). This period is a goal, not a statutory commitment. Consequently, in many cases this goal is not realized. These delays are often associated with the mandated consulting processes that need to be pursued with the State Historic Preservation Office, U.S. Fish and Wildlife Service, or National Marine Fisheries Service. In other cases there are extensions of public notice periods or scheduling complications for the public hearing. The applicant for the Section 404/10 permit has to directly pursue consultations with California Coastal Commission (CCC) and SWRCB. Receipt of an individual Section 404 permit is contingent on previous receipt of permits from the CCC and SWRCB.

This difficult situation is impeded further by the under-staffed local USACE office (two to three permit writers), so permit review durations have been getting longer. For the more complex and contentious situations, the permitting process can extend to 1–2 years. Hence, the USACE permits are often characterized as the critical path permitting process. Given the significant new marine work associated with this cooling technology option, it is likely that the Section 404 permit process will represent a critical path item to the completion of permitting.

Despite the potential for review periods longer than the 120 day target, the USACE did not see any specific barriers or fatal flaws regarding the Section 404 permitting process for the substrate filtering intake system. (Lambert, 2012)

California Public Utility Commission

Pacific Gas & Electric's DCPP is regulated by the California Public Utility Commission (CPUC), which is charged with overseeing investor-owned public utilities. San Luis Obispo County may share the role of Lead Agency for the CEQA review process with the CPUC. CEQA is regulatory statute, which requires state or local regulatory agencies to identify, assess, avoid or otherwise mitigate the significant environmental impacts from the proposed action – the addition of new cooling system technology.

The proposed substrate filtering system will certainly trigger preparation of Environmental Impact Report. The Environmental Impact Report is a detailed report that identifies the potentially significant environmental effects the project is likely to have; identifies feasible alternatives to the proposed project; and indicates the ways in which significant effects on the environment can be mitigated or avoided. This Environmental Impact Report will be also used by other state agencies to support their respective review and approval processes.

Following finalization of the Environmental Impact Report, the CPUC will evaluate whether to certify CEQA compliance. This certification then supports their subsequent decision regarding whether the costs associated with the new cooling system can be reclaimed via a consumer rate base adjustment.

While the CPUC-sponsored review process and decision regarding cost recovery will likely be a lengthy, complex and contentious process, there are no definitive environmental barriers that preclude successfully completion of the CEQA review and a positive record of decision.

California Coastal Commission

The CCC has a broad mandate to protect the coast resources of California, which includes the entire DCPP facility. Consequently, the CCC's environmental concerns address a broad range of subject matter include visual resources, land and marine-based biological resources, land use and socioeconomic concerns (for example, recreational use/access). Despite this comprehensive focus, the CCC has little in the way of specific, objective criteria that could be used to effectively screen any of the cooling technology options from further consideration.

The CCC representatives (Detmer 2012 and Luster 2012) indicated that the Commission recognized that there were no great options to the existing once-through cooling system at DCPP. The CCC believes that almost all of the cooling system technology replacement options present some sort of negative impacts. Given that basis, the CCC may consider options that may present additional onshore or different offshore impacts to help mitigate the offshore environmental consequences of the existing once-through cooling system. The CCC mandate to protect the coastal resources offers this agency some latitude to balance one set of impacts versus another. This evaluation process is on a case-by-case basis, which can be translated into the conclusion that there are few triggers that would automatically preclude any cooling system options from consideration, including the substrate filtering intake system.

The substrate filtering intake system will certainly include significant offshore construction efforts, so the CCC will be focused on the deleterious construction impacts on marine resources (for example, local fish, shellfish, vegetation, hard marine substrate, commercial fishing) and the potentially offsetting positive benefits associated with reducing operational entrainment impacts. These impacts will be reduced simply because there is less likely to be a less rich biological environment and so less entrainment losses despite the largely unchanged water withdrawal rate. Visual impacts in the coastal zone, a typical key CCC subject area, will obviously not be an important factor for this submerged system. Thermal discharge impact matters will also be sideline issues, since they remain largely unchanged with this cooling system.

The CCC consideration of these issues and their follow-on approval process is mostly aligned with the CEQA process. That is, any application for a Coastal Development Permit will be dependent on information generated by associated Environmental Impact Report development process. Consequently, the CCC permit review process will also be aligned with CEQA and consequently its duration will mirror the CEQA timeline (approximately 1 year). That period offers evidence that the Coastal Development Permit could be a critical path permitting process.

California State Lands Commission

Construction efforts in subaqueous lands associated any cooling system modifications will be evaluated/approved by the California State Lands Commission. This review and associated lease approval process can follow three different tracks as shown below:

- **Categorical Exemption** – applicable to those situations where there are no significant environmental impacts and there are no substantive changes in the existing land use. It is unlikely that this option would apply to any of the potential cooling system options that require marine work.

- **Mitigated Negative Declaration** - applicable for work that poses minor environmental impacts, during noncritical seasons, for limited period of time.

- **Environmental Impact Report/CEQA Process** – applicable for work that could potentially generate significant environmental impacts, uses heavy construction equipment, and/or will continue over a significant time periods (months). This review process is not fast-track and could extend for a year.

The State Lands Commission evaluates each project individually and determines the appropriate review/approval path. As the substrate filtering intake system will obviously result in a significant addition of cooling system infrastructure to subaqueous lands, DCPP will not be able to pursue the largely administrative Categorical Exemption path or the streamlined Mitigated Negative Declaration process. This option will invoke the longer, more complex Environmental Impact Report/CEQA review process.

Commission representatives (DeLeon 2012 and Oggins, 2012) explained the current process for nonnuclear coastal power plant lease holders to develop and implement their "implementation plan" to meet California's Once-Through Cooling Policy performance goals has been very slow. Most of these facilities have requested extensions to continue to evaluate the potentially available mitigation strategies. This experience offers evidence that the associated CEQA review will not be an expeditious process. A review period of at least a year is a distinct possibility.

Despite this expected lengthy review process, the associated marine work in subaqueous lands does not appear to offer any specific impacts or regulatory considerations that represent fatal flaws.

State Water Resources Control Board - Central Coast Regional Water Quality Control Board

While the SWRCB has overall permit authority for California's two active nuclear power stations, the CCRWQCB has the follow-on inspection and enforcement role for the issue permits. For DCPP, the SWRCB expects to modify the existing NPDES permit in support of the proposed substrate filtering intake system. The lack of significant disruption to local land surfaces is expected to negate any need for new waste discharge requirements permit for construction impacts to jurisdictional streambed areas and possibly avoid the need to seek coverage under the general storm water permit for construction activity.

The substrate filtering intake construction activities will potentially generate significant, temporary water quality and marine habitat impacts. Installation of the pipeline laterals via the cut and fill process will result in significant localized turbidity impacts and the temporary and permanent loss of a biologically productive marine habitat area. Installation of the system using the tunnel boring machine for the main manifold lines will reduce marine habitat losses and water quality impacts areas.

Operationally, the substrate filtering intake system will appreciably reduce the impingement impacts. This system will not, by itself, reduce the overall water withdrawal or discharge rates. Entrainment-related impacts will be also reduced primarily because water withdrawal is though substrate. Thermal discharge impacts to aquatic life will remain largely unchanged.

Given that the cooling water withdrawal and discharge rates will remain essentially unchanged any revisions to the current DCPP NPDES permit will be limited to compliance provisions of Section 316(b), *California Once-Through Cooling Policy*, Phase II requirements. There will ostensibly be no changes to the current water treatment system, as this option is still a once-through system.

Both the SWRCB and CCRWQCB representatives (Jauregui, 2012 and Morris, 2012) explained that there are no obvious regulatory barriers regarding issuance of this revised NPDES permit for any of the cooling system options currently under consideration, including the substrate filtering intake system. The CCRWQCB and SWRCB will not necessarily preclude cooling system options from consideration, even if these options fall short of full compliance with the performance criteria tied to Section 316(b), *California Once-Through Cooling Policy*, Phase II rules (that is, through-screen velocity less than 0.5 feet/sec and entrainment/impingement levels equivalent that associated with a closed-cooling cycle system). The substrate filtering intake system entrainment reduction performance may fall short of closed-cycle cooling system attributes.

The SWRCB is ultimately a political body (9 individuals), whose members are interested in reviewing as much information/evidence as possible from the applicant and from their own technical staff regarding the feasibility and impacts of various cooling system alternatives. Consequently, none of the SWRCB permits represent a fatal flaw or critical path permitting process to the substrate filtering intake screening system.

San Luis Obispo Air Pollution Control District (APCD)

DCPP is located within the San Luis Obispo APCD, a state-designated non-attainment area for PM-10 and PM-2.5, that is, the District has failed to achieve compliance with the state ambient air quality standards for these pollutants (Willey, 2012). In addition to this air quality compliance issue, there are also local concerns regarding visibility impacts on the nearest visibility sensitive areas, so-called Class I areas that are comprised of national parks (over 6000 acres), wilderness areas (over 5000 acres), national memorial parks (over 5000 acres), and international parks that were in existence as of August 1977. While these situations may have ramifications for those cooling system options that generate significant particulate emissions (closed cooling cycle systems), air quality permits/approvals are not expected to play an appreciable role for the substrate filtering intake system—a system that is not expected to generate any additional operational air emissions.

San Luis Obispo County

While many of potential cooling systems options for DCPP will likely trigger the need for the San Luis Obispo County Planning and Building Department to initiate a conditional use permit process, which in turn will be wholly dependent on a CEQA review process, there is some question as to whether the substrate filtering intake screen system will represent a sufficient trigger for the Condition Use Permitting or CEQA process

The county recently completed a CEQA/conditional use permit review process for the DCPP steam generator replacement project (Hostetter, 2012). The county, along with Nuclear Review Committee, were designated the lead agencies for the CEQA review. The CEQA/conditional use permit process for the steam generator replacement project, which involved significant rounds of negotiations, was characterized as complex and lengthy (years long).

As the county (Hostetter, 2012) predicted that any cooling system option with significant potential for environmental impacts would likely trigger a similar complex and lengthy CEQA/conditional use permit review, the substrate filtering intake system's significant marine impacts will be subject to this rigorous process. The

county can be expected to aggressively pursue the evaluation of alternative cooling system options in addition to reviewing the substrate filtering intake system.

The county also explained (Hostetter, 2012) that is unlikely that they will identify any environmental impact criteria from the CEQA review process that would immediately preclude any of the cooling system alternatives under consideration, including the substrate filtering intake system. The county views the CEQA review process as the mechanism that will ultimately identify the best solution for DCPP – all solutions will be considered.

Other Regulatory Agencies

In addition to the key regulatory agencies described above, there are a number of regulatory agencies that could potentially play a role in the permitting of the various cooling system technology options. The U.S. Fish and Wildlife Service, California Department of Fish & Game, and California Office of Historic Preservation, for example, often play significant regulatory roles in power plant upgrade projects. Construction and operation of the substrate filtering intake system is likely to temporarily and permanently disturb sensitive marine habitat and also reduce impingement impacts to local fish and shellfish. These attributes will make the U.S. Fish and Wildlife Service and California Department of Fish & Game service key parties to CEQA review process, but they will not necessarily trigger the need to secure a 2081 Incidental Take Permit because of the relative lack of marine-based endangered species. Since this option primarily involves offshore work and underwater facilities, it is unlikely the cultural or historic resources (land-based) will be impacted.

Installation of this largely submerged screening system will not alter the overall profile of the DCPP facility and certainly not require significantly tall or large construction equipment. These considerations will preclude significant interactions with California Department of Transportation (Caltrans) (roadway crossings, encroachments, oversized vehicles) and the Federal Aviation Administration (FAA), whose focus would be limited to aviation obstruction impacts posed by tall new permanent or temporary features (less than 200 feet above ground level).

Finally, the California Energy Commission (CEC) will be largely excluded from the permitting processes primarily because substrate filtering intake system will not boost current power levels of the DCPP facility, let alone reach the 50 MW threshold, which would mandate CEC review.

4.1.2.2 Summary

The external approval and permitting assessment for the substrate filtering intake system identified a list of potentially applicable federal, state and local permits and approvals that not surprisingly focused on its significant impacts to the marine environment. The efforts to conduct a successful CEQA review and secure the requisite USACE Section 404 permit, CCC Coastal Development Permit, State Lands Commission Lease, NPDES permit modification will represent the primary regulatory challenges.

These permits are all expected to be contentious and have lengthy review processes that are aligned with the CEQA/Environmental Impact Report review process. The primary difficulty appears to be that the substrate filtering intake system poses significant construction impacts to the sensitive and productive marine habitats, while offering clear impingement benefits, but only some reductions in entrainment impacts real to the current system. Despite this system's somewhat incomplete compliance with the Section 316(b), *California Once-Through Cooling Policy* performance expectations, the consistent message from all of the interested regulatory agencies was that there were no environmental impact issues or regulatory criteria, which would preclude this technology option from securing the necessary construction and operating permits and approv-

als. That is, there were no fatal flaws in the associated regulatory review process, which would preclude the substrate filtering intake system from further consideration.

The assessment also indicated that the Section 404 permit and the CPUC-sponsored CEQA review process will likely represent the critical path review and approval processes (approximately 12 month) for the substrate filtering intake system. This critical path process does not represent a barrier to development of this cooling technology system.

4.2 Impingement/Entrainment Design

4.2.1 General Discussion

The current DCPP shoreline intake system permits fish to enter the onshore pump intake structure directly. There are six traveling water screens per unit with a flow through velocity of 1.95 feet per second (fps). With the use of source water substrate filtering collection system, in lieu of the open intake system, no juvenile/adult fish can enter the intake system. Entrainment of fish egg/larvae would be mostly eliminated by the substrate filtering system.

4.2.2 Detailed Evaluation

The source water substrate filtering collection system technology is a passive system with no moving parts. Fish egg/larvae and juvenile/adult fish exclusion are effectively screened from entering the system through a combination the filtering action of the bottom sediments and the low inflow velocities at the surface of the substrate. The design velocity is not expected to exceed 0.5 feet per second (fps) and so meets the Track 1 impingement criterion associated with Section 316(b), *California Once-Through Cooling Policy*. Even though the total volumetric flow withdrawal will be the same, the substrate filtration and low withdrawal velocities will result in significantly less fish egg/larvae entrainment relative to the existing system. The system effectiveness improves with existence of sufficient sea current velocities sweeping the substrate clear of vegetation and other blocking debris.

4.3 Offsetting Environmental Impacts – Substrate filtering Intake System

4.3.1 General Discussion

The environmental offsets are an environmental management tool that has been characterized as the “last line of defense” after attempts to mitigate the environmental impacts of an activity are considered and exhausted (GWA, 2006). In some cases significant unavoidable adverse environmental impacts may be counterbalanced by some associated positive environmental gains. Environmental offsets, however, are not a project negotiation tool, that is, they do not preclude the need to meet all applicable statutory requirements and they cannot make otherwise “unacceptable” adverse environmental impacts acceptable within the applicable regulatory agency.

In some cases, regulatory agencies may be so constrained by their regulatory foundation that offset opportunities are limited or unavailable. The San Luis Obispo APCD, for example, has the regulatory authority to offset new air emissions in their district from previously banked emission reductions as long as the new emission sources meet appropriate stringent emission performance criteria. The APCD cannot offset new air emissions with reductions in the impingement and entrainment impacts to aquatic life or reductions in land disturbance. In other cases, the regulatory agencies, such as the California Coastal and State Lands Commis-

sions, have a more broadly-based, multi-disciplinary review process that supports a more flexible approach to using environmental offsets to generate the maximum net environmental benefit.

With these considerations in mind, the following assessment of offsetting environmental impacts focuses on identifying both positive and negative construction and operational environmental impacts associated with the construction and operation of the substrate filtering intake system from a broad range of environmental evaluation criteria.

4.3.2 Detailed Discussion

The following sections evaluate the air, water, waste, noise, marine and terrestrial ecological resources, land use, cultural and paleontological resources, visual resources, transportation, and socioeconomic issues associated with construction and operation of the substrate filtering system. Given the wide range of environmental impact subject areas under consideration, the systematic approach used in the Diablo Canyon License Renewable Application process was used (PG&E, 2009). Consequently, following discussion of the individual environmental subject areas, the related consequences are categorized as having either positive or negative small, moderate or large impact significance. The specific criteria for this categorization are shown below:

- **Small:** Environmental effects are not detectable or are minor, such that they will not noticeably alter any important attribute of the resource

- **Moderate:** Environmental effects are sufficient to noticeably alter, but not significantly change the attributes of the resource.

- **Large:** Environmental effects are clearly noticeable and are sufficient to change the attributes of the resource.

The results of these evaluations and impact categorization are subsequently summarized in the SWS-2.

Air

The air quality impacts associated with installation of the substrate filtering system are small given that the primarily marine-based nature of the associated construction activities. There will be little or no opportunity to generate fugitive dust from land disturbance activities, as the primary activity will involve offshore marine work. Some additional vehicle-related air emissions can be expected from the small number of outage workforce personal vehicles and over-the-road project construction vehicles. Self-propelled earthmoving equipment will be unnecessary, but there may be some emission sources on temporary offshore platforms or barges. Construction supplies and piping-related equipment deliveries may be significant in the early phases of construction.

The offshore system may result in a minor decrease in overall DCPP plant efficiency due to increased pumping power demands associated with a more distant offshore buried system of piping. The resulting power reduction is not expected to produce any tangible increase in greenhouse gas or other pollutant emissions from replacement fossil power sources.

Surface Water

Substrate filtering system construction activities are primarily marine-based and they have the potential to generate significant water quality impacts. Placement of the parallel and connecting piping will result in loca-

lized turbidity impacts from disruption of the local seabed – a potentially large negative construction impact if cut and fill practices are used. If the piping systems are installed via a tunneling (tunnel boring machine), this impact could be reduced to a moderate negative level. These construction efforts are not expected to result in any land-based disturbance or storm water-related impacts.

The substrate filtering system will not change the overall cooling water withdrawal or discharge rates.

Groundwater

Given the primarily offshore construction environment associated with the installation of the substrate filtering system, no significant additional ground water resources will be needed.

The substrate filtering system is not expected to require any additional groundwater resources.

Waste

Constructions-related waste, including marine bed sediment and recyclable metals associated with surplus piping materials, will be generated during the outage. Marine dredge spoils or tunneling wastes, depending on the nature of pipe installation, are expected to be considerable. The final disposition of these materials has not been determined. Most of the piping wastes are expected to have salvage value and therefore, not represent a burden to offsite disposal facilities. Disposal of the marine sediment, whether directed to an onsite or offsite disposal area, will represent a moderate construction negative impact.

While the substrate filtering system could potentially include some type of self-cleaning capability, it is unlikely that these buried piping systems can be inspected or cleaned by external actions unless with filter layers removed for inspection. Consequently, there is limited potential for this system to generate additional biological wastes during operation.

Noise

The County of San Luis Obispo County General Plan and Local Coastal Plan limit noise levels to 70 dBA at the property line of the affected public area (Tetra Tech, 2008). Noise impacts from construction activities for the substrate filtering system are not expected to be significant for land-based locations, since the primary work areas will be well offshore. Buffer areas around offshore construction zones will likely be established for safety reasons, but that will also serve to reduce noise impacts to offshore noise receptors (watercraft) and shoreline areas that have public access. Given that PG&E owns all coastal properties north of Diablo Creek to the southern boundary of Montana de Oro State Park and all coastal properties south of Diablo Creek for approximately 8 miles, the potential for construction-related noise impacts to the public along shoreline areas is unlikely. Consequently, the construction activities are expected to pose little or no additional noise impact.

Operational noise levels are expected to be largely unchanged following installation of the new substrate filtering system.

Land Use

Construction activities associated with substrate filtering system are primarily offshore and these activities will likely temporarily preclude normal recreational activities in waters in the immediate construction areas. As mentioned above, buffer zones will be created and maintained during the course of construction for the

safety of the workforce and public. The potential temporary restriction of normal public access in these marine areas represents a small negative impact for this cooling technology option.

The associated buried piping could represent a change in land use in those previously undeveloped subaqueous areas. The buried piping systems will be located in relatively deep waters and therefore should not represent an impediment to surface navigation. Given these impacts, operation of this underwater system is expected to offer a small term negative impact.

Marine Ecological Resources

Substrate filtering system construction activities will potentially generate significant, temporary water quality and marine habitat impacts. Installation of the buried piping systems via the cut and fill process will result in significant localized turbidity impacts and the temporary and permanent loss of a considerable area of biological productive marine habitat – a large negative impact. Installation of the system using the tunnel boring machine will reduce marine habitat losses and water quality impacts to localized areas around the screen modules – a moderate negative impact.

While the offshore system will certainly reduce the impingement and entrainment impacts associated with the DCPP once-through systems, this once-through system results in the lowest impingement biomass rate (weight/gallons of water withdrawn) of all coastal power plants (Tenera, 2011). This is due primarily to its relatively confined engineering cove and exposed rocky coast that create a localized environment where the local fish and shellfish population adapted to strong coastal currents and variable ocean surges making them somewhat resistant to the flow dynamics of cooling water intake systems. While the substrate filtering system does not reduce the overall water withdrawal or discharge rates, its ability to reduce intake velocities and filter the influent water will likely satisfy the performance requirements of Section 316(b) California Once-Through Cooling Policy. Consequently, this system will, operationally, will offer a large positive impact relative to the current condition.

Terrestrial Ecological Resources

Construction activities associated with the substrate filtering system are primarily marine-based and consequently, present little or no impact to land areas. Thus, there will be no construction impacts to terrestrial natural habitat areas or areas with significant ecological value or sensitivity. Operation of the substrate filtering system will similarly present no new threat to these resource areas.

Cultural and Paleontological Resources

Since installation of the substrate filtering system will be confined to subaqueous lands, there is little or no potential to discover new land-based cultural or paleontological resources. Operation of this system will similarly pose no new threat to cultural or paleontological resources.

Visual Resources

All construction equipment will be low profile, that is, the construction support features and equipment will not extend above the height of local facility structures.

The substrate filtering system will be submerged and buried. It will present no permanent change in external profile of the facility.

Transportation

Increased commuting traffic from the construction workforces and construction deliveries could worsen the existing level of service on local roads during the plant outage. While the associated construction period means that related traffic impacts will not be transitory, the necessary workforce is not expected to be large. Consequently, the transportation-related construction impacts should be considered a small negative impact.

Operationally, the substrate filtering system may increase maintenance and service requirements, but any related maintenance staff increases are expected to be minimal. Therefore, there are limited or no operational transportation impacts for this system.

Socioeconomic Issues

While there will be some additional construction-related employment opportunities, these opportunities are not expected to significantly strain local community resources (for example, housing, school, fire/police services, water/sewer).

Operational maintenance staff levels may increase slightly, but not result in any related community service or resource concerns.

4.3.3 Summary

Table SWS-2 summarizes the air, water, waste, noise, marine and terrestrial ecological resources, land use, cultural and paleontological resources, visual resources, transportation, and socioeconomic environmental offsets for the substrate filtering intake system. The construction impacts could be characterized as having moderate to large negative impact significance depending on the nature of the installation method (cut and fill versus tunneling). Both construction practices will involve significant marine-based work that will generate increased turbidity in the seawater near construction areas, produce a sizeable marine spoils waste, and result in some permanent and temporary losses of marine habitat. Theses impacts are not offset by the limited employment opportunities that may be gained during this same period.

Operationally, there is a large positive impact significance related to the substrate filtering systems reduction of the already partially mitigated impingement impacts and its reduction of previously unconstrained entrainment impacts. There is no coincident reduction of cooling water withdrawals, so there is no improvement in thermal discharge impacts. Overall, the operational benefits associated with reductions of impingement and entrainment impacts are largely counter balanced by the construction-related disruption of the marine habitats and degradation of local water quality. While, the cut and fill construction practices will be more disruptive then the tunneling processes, this option does not collectively offer a definitive overall positive environmental outcome.

4.4 First-of-a-Kind to Scale

4.4.1 General Discussion

Use of the source water substrate filtering collection system to supply water to a once-through system is a first of a kind application of this technology. Previous applications of this technology have been used to

supply makeup water to closed cycle cooling systems, which demand a fraction of the amount of water required for once-through cooling.

4.4.2 Detailed Evaluation

Review of available information regarding the substrate filtering collection system suggests that this technology can be scalable in theory for the once-through cooling water demand but is not practical due to the required size of the field necessary to support the flow requirements of DCPP and the fact that efficiency of this system is very difficult to maintain. As noted below if the efficiency cannot be maintained the size of the field must be dramatically increased. Selection of the type of substrate system (natural or artificial filter) depend on the geologic setting of the offshore environment, the seafloor materials present in the area designated for the installation of the substrate filtering collection system, and the site-specific hydraulic conductivity test measurements of the substrate material. For these reasons, it has been determined that this technology should not be used for this application.

4.5 Operability General Site Conditions

4.5.1 General Discussion

In theory, the source water substrate filtering collection system technology can integrated into the existing system by modifying the onshore pump intake structure (the existing open pump forebay will be replaced by a new pump forebay, formed by enclosing the intake cove). The new pump intake forebay would be located at the confluence of the manifold lines. However, over time, the efficiency of horizontal laterals will only go down due to laterals getting clogged, vegetation growth over the substrate field, marine growth inside the laterals and manifolds. These adverse conditions generate great uncertainty to the large scale substrate intake system, which renders it a fatal flaw.

4.5.2 Detailed Evaluation

- The source water substrate filtering collection system components can come with corrosion resistant to the marine environment.

- The imported materials used in the system: artificial filter, crushed stone, and armor rock will be free of deleterious material and essentially nonreactive in the marine environment.

- Periodic bottom surveys will be needed to assess substrate conditions. Significant build-up of vegetation or fine materials (silts or clays) on the bottom could interfere with the efficient operation of the system, that is, clogging of laterals.

- Even though frequent inspection and cleaning of laterals, using hydraulic jets or mechanical brushes, can in theory maintain optimum water production. However, due to the large field of laterals/manifold networks, this maintenance cleaning of laterals with hydraulic jet and brushes will be not practical.

- Limitation of a laterals inspection, maintenance and cleaning program need to be determined.

- System must be overdesigned to account for lateral plugging where rehabilitation results in less than 100 percent of the initial flow conditions. The unknown is on the determination of what over design margin shall be. If the laterals are designed with 50 percent and 25 percent efficiency, the number of laterals required and substrate area impacted will be two and four times larger.

In summary, despite manual cleaning of vast number of lateral is possible in theory, it is not practical for a once-through cooling system application such as DCPP. All the envelop design parameters given in Section 3 are based on a 100 percent efficiency, which can not be maintained following a plant operation. Exactly how much design margin is needed to maintain a given design efficiency can not be known nor accurately predicted. This will result in generally less reliable intake system, as compared to other traditional intake systems. Therefore, from operation point of view, this technology is considered a fatal flaw, when it is applied to a once-through cooling system such as DCPP.

4.6 Seismic and Tsunami Issues

4.6.1 General Discussion

Design criteria will be similar to that used for to design the existing structures. The system can properly be designed to accommodate the seismic requirements and design wave forces.

4.6.2 Detailed Evaluation

- The manifold piping will likely cross the Shoreline Fault Zone/N40W Fault (Pacific Gas and Electric Company, 2011, Figure SWS-3).
- The structural design will use the same seismic category that was used for the current shoreline intake.
- The offshore substrate system will be designed to withstand design wave forces.

4.7 Structural

4.7.1 General Discussion

The substrate filtering collection system can be designed properly to withstand critical loading, including full collapse pressure on the laterals and manifold piping.

4.7.2 Detailed Evaluation

The offshore substrate filtering collection system is an independent system delivering the cooling water to the enclosed shoreline intake cove via a large conduit. It does not interfere with the shoreline pump intake structural.

4.8 Construction

4.8.1 General Discussion

The major construction activities for using this technology include:

- Dredging/excavate the seabed for placement of laterals and manifold lines;
- Employing horizontal drilling techniques with the natural filter system to minimize substrate disturbance.

- Installing laterals offshore. Installation consists of placing laterals in the excavated trench and covering with backfill material (either excavated substrate or artificial filter), crushed stone, and armor stone.

- Installing the pump intake forebay at the confluence of the manifold suction line.

4.8.2 Detailed Evaluation

- Substrate excavation may require specialized excavation equipment where hard rock layers are encountered.

- Turbidity curtains may be required to control suspended solids.

- Upon completion of the laterals and manifold, the seabed will be graded and covered by crushed stone and then protected with riprap and topped by armor stone for stability and scour protection

4.9 Maintenance

4.9.1 General Discussion

There will be a significantly greater operation and maintenance efforts associated with the source water substrate filtering collection system technology as compared to the existing shoreline intake. In fact, the level of maintenance needed can be so high and demanding that is not practical. The major maintenance concerns are plugging of the substrate filter media and encrustation or plugging of lateral openings. Due to the vast number of laterals, it will be not practical to manually clean the laterals off deposits/clogging using hydro jets or mechanical brushes.

4.9.2 Detailed Evaluation

- Periodic dredging may be required if a build-up of fine materials or organic debris is observed on the substrate.

- Periodic undersea video inspections of laterals will be needed to detect encrustation or plugging of lateral openings.

- Cleaning of laterals using water jet or brush techniques can be performed if encrustation or plugging is observed following an inspection. For a large field of laterals this will not be practical.

- Limitations of a laterals inspection, maintenance and cleaning program can result in degradation of the lateral systems and eventual flow reduction to the receiving manifolds, may be even flow stoppage.

5. Conclusion

While the substrate infiltrating system offers significant reduction in entrainment by screening out fish egg/larvae, screens out juvenile and adult fish, and it complies with impingement mortality rule with less than 0.5 fps intake velocity, this technology is considered a fatal flaw when evaluated against the First of a Kind, the Operability General Site Conditions and Maintenance criterion. The technology could be theoreti-

cally be scaled to meet the DCPP flow requirement but in practice it can not be recommended and there is no assurance a maintenance program can maintain the intake system efficiency at 100 percent. This is because, for a large field of horizontal laterals on a once-through cooling system application such as for DCPP, the amount of maintenance needed is not practical or dependable. With likely vegetation growth, silt/clay presence and bio-growth, continuous flow though laterals can not be assured. If the ultimate efficiency at end of plant life become 50 percent or 25 percent efficiency, respectively, the magnitude of the lateral/filter installation needs to be twice and four times as large as currently presented in this report. This level of uncertainty will not be acceptable.

6. References

Bishop, J. Policy on Use of Coastal and Estuarine Waters for Power Plant Cooling – CalEPA, SWRCB, 2011.

DCPP, 2009. Auxiliary Salt Water System, System Training Guide E-5, May 2009

DCPP, 2010. Circulating Water System, System Training Guide E-4, May 2010.

DeLeon, J., California State Lands Commission (personal communications, April 16, 2012)

Detmer, A., California Coastal Commission (personnel communications, April 17, 2012)

Enercon., Diablo Canyon Power Plant Cooling Tower Feasibility, March 2009.

Government of Western Australia (GWA), Environmental Offsets Position No. 9, January 2006

Harrison, L.L., 1987, *History of the Diablo Canyon Breakwater*, revision 1, draft, April 17.

Hostetter, R., San Luis Obispo County Planning and Building Department, April 17, 2012)

Jauregui, R., State Water Resources Board (personnel communications, May 2, 2012)

Lambert, J., U.S. Army Corps of Engineers (personal communication, April 11, 2012)

License Renewal Application Diablo Canyon Power Plant Unit 1 and 2 - Appendix E Applicants Environmental Report – Operating Renewal Stage (Chapter 4), PG&E, November 2009

Luster, T., California Coastal Commission (personal communication, April 17, 2012)

Oggins, C., California State Lands Commission (personal communications, April 16, 2012)

Pacific Gas and Electric Company, 2011, *Report on the Analysis of the Shoreline Fault Zone, Central Coastal California*, report to the U.S. Nuclear Regulatory Commission, January.

Taylor, S.W. and Headland, L.C., 2005, Analysis and Design of Infiltration Seawater Intakes, Bechtel Corporation, in *World Water and Environmental Resources Congress*, Anchorage, AK, May 15-19, American Society of Civil Engineers.

Tenera Environmental, Comments – Proposed EPA 316(b) BTA Impingement Standard - Open Coastal Power Plants Using Once-Through Cooling (PG&E Diablo Canyon Power Plant), July 2011.

Tetra Tech, California's Coast Power Plants: Alternative Cooling System Analysis, Section C. Diablo Canyon Power Plant, 2008.

Tetra Tech, Diablo Canyon Power Plant Cooling Tower Feasibility, March 2009.

USEPA, Proposed Regulations to Establish Requirements for Existing Cooling Water Intake Structures at Existing Facilities, EPA – 820-F-11-002, March 2011.

Von Langen, P., Central Coast Regional Water Quality Control Board (personal communication April 16, 2012)

Willey, G., San Luis Obispo Air Pollution Control District (personal communication, April 19, 2012)

Table SWS-1.
Environmental Permit/Approval Assessment: Substrate Filtering Intake System
Diablo Canyon Power Plant

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path	Fatal Flaw
National Environmental Policy Act – Bureau of Land Management (BLM) or Other Responsible Lead Federal Agency (Record of Decision, ROW)	Not applicable – the addition of the substrate filtering intake system does not constitute major federal action (federal land, funding).	Not applicable	NA	NA
Section 404/10 Permit – U.S. Army Corps of Engineers (USACE)	Installation of the substrate filtering intake system, either via cut and fill processes or tunneling, will generate significant impacts to waters of U.S. and will involve work in navigable waters. Individual form of permit will be required.	120 days from complete application (goal) ~12 months (expected)	Potential	NA
Section 401 Water Quality Certificate – U.S. Army Corps of Engineers (USACE) & Regional Quality Control Board (RWQCB)	The Section 401 permit process will parallel Section 404 permit process.	~12 months (expected)	Potential	NA
Nationwide Permit – U.S. Army Corps of Engineers	Not applicable - the installation of the substrate filtering intake system will generate significant impacts to waters of U.S. that cannot be addressed by the nationwide permitting process.	Not applicable	NA	NA
Section 7 Consultation with U.S. Fish and Wildlife Service (Endangered Species Act of 1973)	Installation of the substrate filtering intake system will pose significant impacts marine habitat and aquatic life and also serve to reduce operational impingement and entrainment losses.	Connected to CEQA process	No	No
Notice of Proposed Construction or Alteration – Federal Aviation Administration (FAA)	Not applicable - the addition of the addition of the substrate filtering intake system will not result in any exterior changes to existing structures.	Not applicable	NA	NA
Notice of Proposed Construction or Alteration – FAA	Not applicable - the addition of the substrate filtering intake system will not demand the services of a crane or other construction equipment in excess of 200 feet agl.	Not applicable	NA	NA

Table SWS-1.
Environmental Permit/Approval Assessment: Substrate Filtering Intake System
Diablo Canyon Power Plant *(cont.)*

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path	Fatal Flaw
Multiple-Use Class L Limited Land Use Designated Utility Corridor – Bureau of Land Management (BLM) or Other Responsible Federal Agency	Not applicable - the addition of the substrate filtering intake system will not require any additional land, nor involve any exterior changes to existing structures	Not applicable	NA	NA
California Public Utility Commission (CPUC) Approval	CPUC will likely be the Lead Agency for the California Environmental Quality Act (CEQA) review process regarding the proposed substrate filtering intake system. The CEQA review process trigger development of a comprehensive EIR.	~12 months	Potential	No
California Energy Commission (CEC) – Final Decision	Not applicable – the addition of the substrate filtering intake system will not result in a net power capacity (increase) > 50 MW, the threshold for CEC.	Not applicable	NA	NA
Coastal Development Permit - California Coastal Commission/Local Coastal Programs	Applicable because of the considerable offshore and nearshore development within the coastal zone. While there are no specific fatal flaws with the substrate filtering intake system, the significant construction-related marine habitat impacts and associated limited reduction in operational entrainment losses are likely to make for a contentious approval process.	Connected to CEQA (~12 months)	Potential	NA
Coastal Development Lease – California State Lands Commission	Applicable because of the considerable offshore development on subaqueous lands. While there are no specific fatal flaws with the substrate filtering intake system, the significant construction-related marine habitat impacts and associated limited reduction in operational entrainment losses are likely to make for a contentious approval process.	Connected to CEQA (~12 months)	Potential	NA

Table SWS-1.
Environmental Permit/Approval Assessment: Substrate Filtering Intake System
Diablo Canyon Power Plant *(cont.)*

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path	Fatal Flaw
Regional Pollution Control District Authority to Construct (ATC) – San Luis Obispo Regional Air Pollution Control District	Not applicable - the substrate filtering intake system will not generate any additional operational air emissions.	Not applicable	NA	NA
Regional Control District Permit to Operate (PTO) – San Luis Obispo Air Pollution Control District	Not applicable - the substrate filtering intake system will not generate any additional operational air emissions.	Not applicable	NA	NA
Title V Federal Operating Permit – San Luis Obispo Air Pollution Control District and USEPA	Not applicable - the substrate filtering intake system will not generate any operational additional air emissions.	Not applicable	NA	NA
Title IV Acid Rain Permit - USEPA	Not applicable - the substrate filtering intake system will not generate any additional operational air emissions.	Not applicable	NA	NA
Dust Control Plan – San Luis Obispo Air Pollution Control District	Not applicable – construction of the substrate filtering intake system expected to disturb little of ground surfaces and so there is little potential to generate significant dust emissions. The substrate filtering intake system, itself, will not generate any additional air emissions.	Not applicable	NA	NA
NPDES Industrial Discharge Permit – Central Coast Regional Water Quality Control Board (CCRWQCB) and State Water Resources Board	The substrate filtering intake system will not change the cooling water withdrawal or blowdown rates. This system is not expected to demand any changes in the water treatment system. Any subsequent required alteration of the current NPDES permit will be minor.	~6 months	No	No
Notice of Intent (NOI) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activity, Central Coast Regional Water Quality Control Board (CCRWQCB)	Not applicable – construction of the substrate filtering intake system is not expected to significantly disturb ground surfaces or alter storm water management features onsite.	Not applicable	NA	NA

Table SWS-1.
Environmental Permit/Approval Assessment: Substrate Filtering Intake System
Diablo Canyon Power Plant *(cont.)*

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path	Fatal Flaw
Storm Water Pollution Prevention Plan (SWPPP) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activity – Central Coast Regional Water Quality Control Board (CCRWQCB)	Not applicable – construction of the substrate filtering intake system is not expected to disturb ground surfaces or alter storm water management features onsite.	Not applicable	NA	NA
Notice of Intent (NOI) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Industrial Activity, Central Coast Regional Water Quality Control Board (CCRWQCB)	Not applicable - DCPP NPDES permit addresses operational storm water. No changes to existing storm water management system are expected from addition of the substrate filtering intake system.	Not applicable	NA	NA
Storm Water Pollution Prevention Plan (SWPPP) – National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Industrial Activity, Central Coast Regional Water Quality Control Board (CCRWQCB)	Not applicable - DCPP NPDES permit addresses operational storm water. There is no separate operational phase SWPPP.	Not applicable	NA	NA
2081 Permit for California Endangered Species Act of 1984 (Fish and Game Code, §2050 through 2098) – California Department of Fish & Game (CDFG)	The installation of the substrate filtering intake system is expected to impact marine habitat areas, but there are no threatened or endangered species in the immediate marine area.	Not applicable	NA	NA
Lake and Streambed Alteration Agreement - California Department of Fish & Game (CDFG)	Not applicable – the addition of the substrate filtering intake system will not results in impacts to jurisdictional streambed areas (Waters of the State).	Not applicable	NA	NA
Waste Discharge Requirements (WDR) – Central Coast Regional Water Quality Control Board	Not applicable – the addition of the substrate filtering intake system will not results in impacts to jurisdictional streambed areas (Waters of the State).	Not applicable	NA	NA

Table SWS-1.
Environmental Permit/Approval Assessment: Substrate Filtering Intake System
Diablo Canyon Power Plant *(cont.)*

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path	Fatal Flaw
Section 106 Review – Office of Historic Preservation (OHP)	Not applicable - the substrate filtering intake system will not demand any additional land nor generate any new surface disturbances.	Not applicable	NA	NA
Notification of Waste Activity – Resource Conservation and Recovery Act (RCRA) Hazardous Waste Identification Number (Small Quantity Generator) – Construction Phase - Department of Toxic Substance Control, USEPA, San Luis Obispo County Environment Health Services - California Unified Program Agency	Installation of the substrate filtering intake system could potentially require an ID number to support management or construction wastes, unless current DCPP ID will be used.	1-2 weeks	No	No
Notification of Waste Activity - RCRA Hazardous Waste Identification Number (Small Quantity Generator) – Operation - Department of Toxic Substance Control, USEPA, San Luis Obispo County Environmental Health Services - California Unified Program Agency	Not applicable – the addition of the substrate filtering intake system will allow for the continuing use of the existing hazardous waste ID number. There will be not impacts to the onsite hazardous treatment facility (oil separation unit).	Not applicable	NA	NA
SPCC Plan - 40 CFR 112 and Aboveground Petroleum Storage Act – San Luis Obispo Environmental Health Services- California Unified Program Agency and USEPA	Not applicable – the addition of the substrate filtering intake system is not expected to require additional water treatment chemicals.	Not applicable	NA	NA
Underground Storage Tank Permit - San Luis Obispo County Environmental Health - California Unified Program Agency and State Water Resources Board	Not applicable - the addition of the substrate filtering intake system is not expected to require force the relocation of underground tanks.	Not applicable	NA	NA

Table SWS-1.
Environmental Permit/Approval Assessment: Substrate Filtering Intake System
Diablo Canyon Power Plant *(cont.)*

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path	Fatal Flaw
Risk Management Plan (Clean Air Act 112r) – San Luis Obispo County Environmental Health Services - California Unified Program Agency and USEPA	Not applicable – the addition of the substrate filtering intake system will not require the addition of any new volatile chemicals.	Not applicable	NA	NA
Emergency Planning and Community Right-to-Know Act (EPCRA) – 40 CFR 311 & 312 - San Luis Obispo County Environmental Health Services - California Unified Program Agency and USEPA	Not applicable – the addition of the substrate filtering intake system is not expected to require any new chemicals are stored in quantities that exceed applicable thresholds (for example, 10,000 lbs for hazardous chemicals, 500 lbs for extremely hazardous chemicals).	Not applicable	NA	NA
Land Use Zones/Districts Approval - San Luis Obispo County Department of Planning and Building	Not applicable – the addition of the substrate filtering intake system will be an internal improvement conducted wholly within existing structures.	Not applicable	NA	NA
Condition Use Plan Amendment - San Luis Obispo County Department of Planning and Building	While the scope of work associated with installation of this offshore submerged facility may pose some jurisdictional issues, the substrate filtering intake system will likely be addressed by an amendment to the existing Conditional Use Permit.	Not applicable	NA	NA
Grading Plan Approval or Permit - San Luis Obispo County Department of Public Works & Planning and Building	Not applicable – there will be no onsite grading during the installation of the offshore substrate filtering intake system.	Not applicable	NA	NA
Erosion and Sediment Control Plan (Rain Event Action Plan) - San Luis Obispo County Department of Public Works	Not applicable - similar to the construction phase SWPPP. No separate submittal is expected to be directed to the county.	Not applicable	NA	NA
Building Permit (including plumbing and electrical) – San Obispo County Building Division	Not applicable - the addition of the substrate filtering intake system may demand an individual or set of county Building permits.	Not applicable	NA	NA

Table SWS-1.
Environmental Permit/Approval Assessment: Substrate Filtering Intake System
Diablo Canyon Power Plant *(cont.)*

Permit/Approval	Assessment	Permit Review Period (Preconstruction)	Critical Path	Fatal Flaw
Domestic Water Supply Permit (public potable water) -San Obispo County Department of Environmental Health	Not applicable – no new potable water systems are planned.	Not applicable	NA	NA
San Luis Obispo County Well Water Permit - San Luis Obispo County Environmental Health Services	Not applicable – no new wells to be developed.	Not applicable	NA	NA
California Department of Transportation (Caltrans) – Oversize/Overweight Vehicles	Not applicable – the substrate filtering intake elements and associated piping are expected to be oversized.	Not applicable	NA	NA
Caltrans Heavy Haul Report (transport and delivery of heavy and oversized loads)	Not applicable - the velocity cap elements and associated piping are expected to be oversized.	Not applicable	NA	NA
Resource Conservation (RC) Land Use Management Approval	Not applicable - while local municipality rules may supersede this regional land use//watershed protection-related project approval process, this is not the case for DCPP.	Not applicable	NA	NA
Temporary Power Pole – Local municipality or San Luis Obispo County Public Works Department	Not applicable - the installation of the substrate filtering intake system is not expected to require local power poles.	Not applicable	NA	NA
Fire Safety Plan Approval, Certificate of Occupancy, Flammable Storage – San Luis Obispo County Fire Department	The addition of substrate filtering intake system may require minor revisions to the existing Fire Safety Plan.	1 month for approval of Fire Safety Plan.	No	No
Sewer and Sewer Connections – San Luis Obispo County Environmental Health Services	Not applicable - No new sanitary connections are envisioned.	Not applicable	NA	NA
Road Crossing or Encroachment Permit (Caltrans)	Not applicable – the addition of substrate filtering intake system will not pose any road crossing or encroachment issues.	Not applicable	NA	NA

Table SWS-2. Offsetting Impacts for the Substrate filtering Intake Diablo Canyon Power Plant *(cont.)*

Category	Impacts – Construction	Impacts – Operations	Magnitude	Construction Impact Significance	Operation Impact Significance
Air	Minor increase in greenhouse gases NOx, volatile organic compound, CO, and PM from construction equipment, material deliveries, commuting workforce. Increased greenhouse gas emissions from replacement fossil-fuel generation to offset the short term loss of DCPP generation during the plant outage to install substrate filtering system.	While the substrate filtering system could result in some reduction of plant efficiency, but there should be no significant changes in overall air quality impacts or greenhouse gas emissions during operation.	Insignificant temporary increase in CO_2 greenhouse gas emissions from temporary increase in commuting traffic during associated plant outage.	Small Negative	None
Surface Water	Construction activities are primarily marine-based and they have the potential to generate significant water quality impacts from disruption of the intertidal and sub-tidal lands. Cut and fill installation practices will be more disruptive than the tunneling option.	Operational cooling water withdrawal and discharge rates will be remain largely unchanged.	Not applicable	Large Negative- cut and fill Moderate Negative - tunneling	None
Groundwater	No additional ground water resources will be needed to support construction.	No additional ground water resources will be needed to support operations.	Not applicable	None	None
Waste	A significant marine sediment wastes will be generated to facilitate installation of the offshore piping system.	No increase in waste generation is expected from maintenance activities on the substrate filtering system.	Marine Spoil Wastes (pending subsequent phase of assessment)	Moderate Negative	None

Noise	Buffer areas around offshore construction zones will serve to reduce noise impacts to offshore noise receptors (watercraft) and distant shoreline areas that have public access.	Operational noise levels are expected to be largely unchanged as a result of the substrate filtering system.	Noise impacts above the 70 dBA threshold value in areas with public access are not expected to occur during construction or operation.	None	None

Table SWS-2. Offsetting Impacts for the Substrate filtering Intake Diablo Canyon Power Plant *(cont.)*

Category	Impacts – Construction	Impacts – Operations	Magnitude	Construction Impact Significance	Operation Impact Significance
Land Use	Construction activities are primarily offshore and they may temporarily preclude normal recreational activities in nearby waters.	The substrate filtering system and associated piping represent a change in land use of the marine bed and could preclude some waterborne activities.	Work schedule (pending subsequent assessment)	Small negative	Small negative
Marine Ecological Resources	Construction will potentially generate significant, temporary water quality and marine habitat impacts (localized turbidity impacts and loss of marine habitat). These impacts will be more significant for the cut and fill installation option then the tunneling option.	Further reduces impingement impacts that are already mitigated by engineered cove and local fish populations resistant to heavy currents and ocean surges. Also reduces entrainment losses because of the effective seabed filter. Overall water withdrawal or discharge rates are unchanged.	Disturbed area (pending subsequent assessment)	Large Negative – cut and fill Moderate Negative - tunneling	Large Positive
Terrestrial Ecological Resources	Since construction will be confined to previously disturbed land, there is no potential to disturb natural habitats or other areas with significant ecological value or sensitivity.	No permanent loss of natural habitat areas or other areas with significant ecological value or sensitivity.	Not applicable	None	None

Table SWS-2. Offsetting Impacts for the Substrate filtering Intake Diablo Canyon Power Plant *(cont.)*

Category	Impacts – Construction	Impacts – Operations	Magnitude	Construction Impact Significance	Operation Impact Significance
Cultural & Paleontological Resources	Since construction will be confined to previously disturbed land there is little or no potential to discover new cultural or paleontological resources in these developed areas.	No permanent loss of cultural or paleontological resources.	Not applicable	None	None
Visual Resources	All construction equipment will be low profile, that is, not extend above the height of local facility structures.	The substrate filtering system will be submerged and present no permanent change in external profile of the facility.	Not applicable	None	None
Transportation	Increased traffic from the construction workforce and construction deliveries could temporarily worsen the existing level of service on local roads during the plant outage.	The deepwater system will not significantly alter the current number of plant deliveries or operating personnel.	Workforce, Level of Service (pending subsequent assessment)	Small Negative	None
Socioeconomic Issues	While there will be some additional construction-related employment opportunities, these opportunities are not expected to significantly strain local community resources (for example, housing, school, fire/police services, water/sewer).	Maintenance staff levels are expected to be largely unchanged in response to the substrate filtering system.	Workforce (pending subsequent assessment)	Small Positive	None

Notes: Levels of Impact of Significance

Small: Environmental effects from not detectable to minor, such that they will not noticeably alter any important attribute of the resource
Moderate: Environmental effects are sufficient to noticeably alter, but not significantly change the attributes of the resource.
Large: Environmental effects are clearly noticeable and are sufficient to change the attributes of the resource.