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Technical Memorandum

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Nipomo Community Services District

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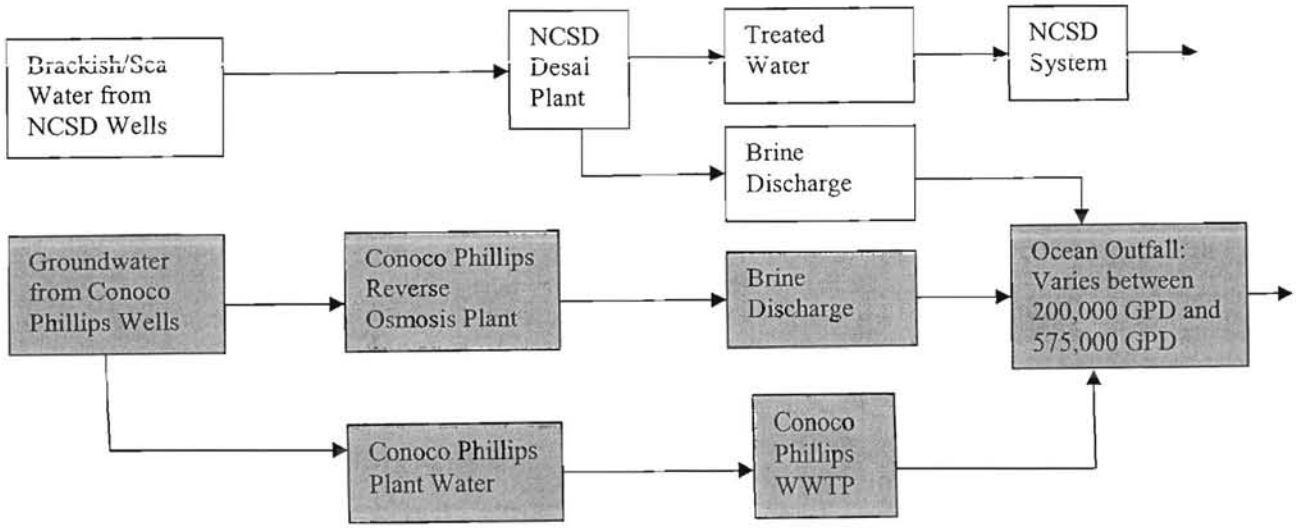
Subject: Technical Memorandum 7: Conoco Phillips Water Supply Feasibility Study

NCSD wishes to explore the possibility of supplementing its potable supplies with desalinated sea water or brackish groundwater, using the existing ocean outfall pipeline at the Conoco Phillips refinery for brine discharge. This Technical Memorandum examines the proposed project, explores the potential for such a project to cost effectively supplement potable water supply, and provides a scope of work for a feasibility study to consider this issue in detail should NCSD choose to pursue this alternative further.

1. Proposed Project Concept

Conoco Phillips currently processes almost 1.3 MGD of ground water extracted from four groundwater wells. This water is used in plant processes, cooling towers, and boilers. All plant process water is treated prior to release from the plant. Conoco Phillips is permitted to discharge up to 575,000 GPD of treated plant effluent and brine from their reverse osmosis (RO) facility, via an ocean outfall pipeline (Outfall). NCSD would like to explore the possibility of utilizing this existing Outfall for a desalination (desal) project to provide additional water for the NCSD system.

NCSD proposes utilizing slant drilling technologies to draw seawater or brackish groundwater, treating this water in a separate RO desal plant, and discharging brine waste from the desal process to the ocean via the Outfall. A diagram of the proposed project is shown below. Existing Conoco Phillips facilities are shaded.



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2. Conoco Phillips Facilities and Operations

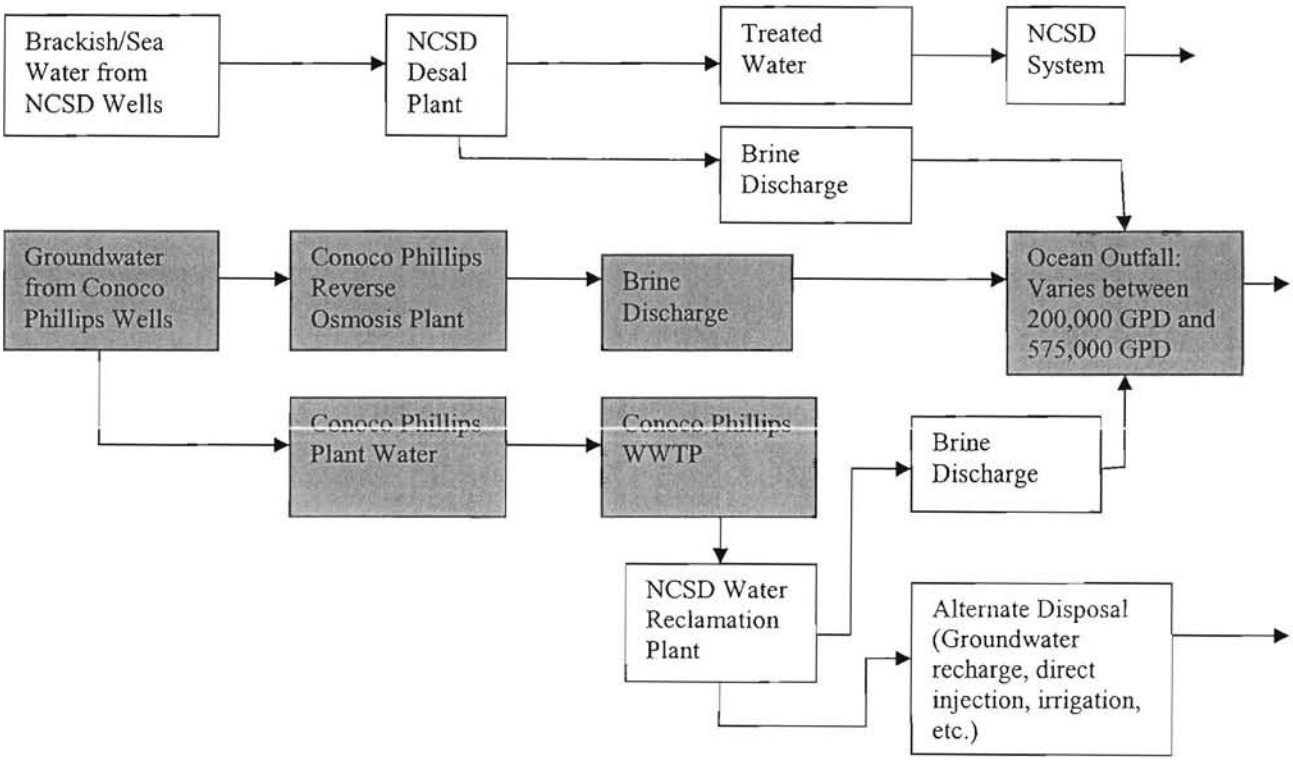
Conoco Phillips facilities include the existing RO plant and their ocean outfall pipe. They also operate four groundwater wells, which provide up to 1.3 MGD of groundwater for their operations. These wells would not be involved in the project, as plant operations cannot have the water source affected. Further, due to size limitations, use or expansion of their existing RO plant for the NCSD desal plant would not be feasible.

Conoco Phillips has indicated that they may be willing to negotiate for use or purchase of land for NCSD slant wells for brackish groundwater or ocean water as feed to the desal plant and for a separate NCSD desal plant site.

3. Potential Fatal Flaws

Conoco Phillips currently utilizes all of the permitted capacity in the Outfall, so there is no excess capacity for brine discharge from a NCSD desal plant. However, one possible way NCSD could potentially generate Outfall capacity would be by providing alternate disposal of Conoco Phillips' treated plant effluent, such as groundwater recharge, direct injection, or landscape irrigation.

According to Conoco Phillips staff, the treated plant water could potentially contain residual oil, water-treating chemicals, and process chemicals. It would likely require additional treatment prior to discharge to ground water. A diagram of the proposed revised project is shown below.



The feasibility of this proposal would need further review, including determination of Conoco Phillips' requirements regarding handling of their effluent, treatment requirements of that effluent prior to discharge, permitting requirements, additional costs related to effluent treatment, etc. Before pursuing this project further, NCSD should determine if Conoco Phillips will allow alternative treatment, disposal and/or reuse of their treated plant water for purposes of generating additional

Outfall capacity. If so, NCSD should determine how much capacity can be generated and if such effort is financially viable.

4. Potential Benefits

If this project is deemed feasible, it could potentially provide additional potable water for the NCSD system. However, financial viability for this project concept depends on two assumptions: that sufficient capacity can be generated is the Outfall, and that sufficient recovery can be achieved through RO.

Conoco Phillips currently uses the Outfall for discharge of both treated process water and waste brine from their own RO plant. The treated process water accounts for approximately 75% of the volume of discharge water. Assuming that all of this treated wastewater could be disposed of via alternate means (groundwater recharge, irrigation, etc.), then approximately 430,000 GPD of capacity would be available in the Outfall.

Depending on the source water used and the number of passes through the RO filters, a maximum recovery of between 70% and 90% can be expected. In general, the higher the salinity of the source water, the less recovery can be achieved. That is, seawater will generally show less recovery than brackish groundwater.

For purposes of this memo, a recovery of 80% is assumed. With 430,000 GPD of brine allowed to be discharged via the Outfall, approximately 2.2 MGD of potable water could be processed through the desal plant. This volume would provide up to 1.7 MGD or 1,900 AFY of desalinated water to the NCSD potable water system.

Actual achievable recovery of the RO system will need to be determined and potential Outfall capacity and will need to be reviewed and approved by Conoco Phillips in the development of the Feasibility Report for this project. Ultimately, the District plans to generate up to 5200 AFY of supplemental water through desalination. Generation of this volume may require an alternate discharge location or a modification to the existing facility and permit.

5. Cost Analysis

While there may be potential benefits for both NCSD and Conoco Phillips from pursuing this project, the question remains whether those benefits outweigh the potential costs. Based on discussions with other water agencies utilizing desal technologies, construction costs for an RO plant designed for treatment of 2.2 MGD could range between $5 million and $9 million. Previous cost estimates have placed the operating cost to treat brackish or seawater at $2,000 to $4,000/AF (Kennedy/Jenks, 2001). Assuming up to 1,900 AFY water produced, this project would cost NCSD between $3,800,000 and $7,600,000 per year for water treatment.

This estimate does not include cost of land. While land could potentially be available on Conoco Phillips' site for construction of the desal plant and drilling of the wells, lease or purchase arrangements with Conoco Phillips for use of that land have not been initiated.

This estimate also does not include cost for drilling, operating, and maintaining the brackish/seawater wells. Nor does this cost estimate address costs associated with infrastructure improvements necessary to tie in the desal plant to the existing NCSD water system. Such additional costs would need to be addressed in a detailed Feasibility Study should this project move forward.

6. Feasibility Study

Given the equally high costs of other supplemental water sources, we recommend that NCSD further investigate this alternative for supplementing their potable water system. A Feasibility Study should

be developed to determine if this is truly a technically and economically viable project. A recommended Scope of Work for this Feasibility Study is outlined below.

The Feasibility Study should first review the project in more detail with Conoco Phillips to determine if pursuing the project further is viable for them. If so, it should then address the following key areas: technical feasibility, conceptual design, environmental impacts, regulatory requirements, economic analysis, and potential financing sources. Specific issues to address under each key area are identified below:

Technical Feasibility

- Determine Conoco Phillips treated plant effluent water quality prior to discharge.
- Determine the actual available capacity that could be discharged to the Outfall (as allowed by Conoco Phillips and by permit) and the corresponding rate of desal to be achieved.
- Develop proposed treatment and discharge alternatives in sufficient detail for agency review.
- Identify any "fatal flaws" associated with technical feasibility.

Conceptual Design

- Determine what modifications must be made to the existing NCSD system to tie into the desal plant.
- Confirm whether ocean water or brackish seawater will be drawn by the new NCSD wells.
- Determine what modifications must be made to the Conoco Phillips refinery site to accommodate the new wells and associated infrastructure.
- Confirm whether the desal plant can be located on Conoco Phillips property or whether an alternate site must be found. Determine what modifications must be made to the Conoco Phillips refinery site layout to accommodate the new desal plant and associated infrastructure. Or, identify potential alternative sites for the desal plant.
- Identify any "fatal flaws" associated with facility design.

Environmental Impacts

- Evaluate the Environmental Impacts of the Reclamation Plant.
- Evaluate the hydrogeologic impacts of brackish or ocean water wells on the environment.
- Identify any environmental impacts associated with the selected desal plant site.
- Identify any marine impacts associated with the brine discharge.
- Identify any "fatal flaws" associated with environmental impacts and review.

Regulatory Requirements

- Determine permitting and environmental review requirements for treatment and discharge/reclamation/reuse of Conoco Phillips' treated plant effluent.
- Determine if there are additional permit limitations on discharge, such as rate or concentration, which would limit feasibility of discharge of brine.
- Identify any "fatal flaws" associated with permitting or compliance.

Economic Analysis

- Confirm capital costs, construction costs, and operation and maintenance costs for the desal plant, wells, and associated facilities.
- Confirm impact of adding desal water to the NCSD system on NCSD customers' rates.
- Identify staffing requirements, compliance requirements, etc. associated with maintaining and operating the existing ocean outfall structure and the new desal plant.
- Identify costs associated with acquiring land or rights-of-use for the desal plant site and well sites.
- Determine the power requirements for the desal plant. Determine if it is possible to operate only during off-peak periods, and, if so, what the associated storage requirements are.
- Identify any "fatal flaws" associated with project economics.

Financing Sources

- Determine sources of financing (grants or loans) that may be available for assistance with this sort of project.
- Identify any "fatal flaws" associated with financing this sort of project.

7. References

Anderson, James. Superintendent Health and Safety, Conoco Phillips Refinery. Personal Correspondence and Discussions. March - June, 2007.

Kennedy/Jenks Consultants. *Evaluation of Water Supply Alternatives, Nipomo Community Services District*. October, 2001.

Veerapaneni, Srinivas et al. "Reducing Energy Consumption for Seawater Desalination."*American Water Works Association Journal*. Vol 99, No. 6, June 2007. pp 95-106.