Delta Vision

Context Memorandum: Utilities

This context memorandum provides critical information about utilities to support policy making. As they are developed, the context memos will create a common understanding and language about the critical factors in establishing a Delta Vision.

This is an iterative process and this document represents the beginning of a dialogue with you about how best to understand these lessons and to inform recommendations by the Delta Vision Blue Ribbon Task Force. You have two weeks to submit comments that may be incorporated into the next iteration.

You may submit your comments in two ways: either online at dv_context@calwater.ca.gov or by mail. If you are using mail, please send your comments to: Delta Vision Context Memo: Utilities, 650 Capitol Mall, 5th Floor, Sacramento, CA 95814.

Your attributed comment will be posted on the Delta Vision web site (http:www.deltavision.ca.gov). Please cite page and line number with specific comments; general comments may be keyed to sections.

Your participation in this iterative process is valuable and important and is greatly appreciated. Thank you for your comments.

Context Memorandum: Utilities

Iteration 1: June 22, 2007

Section 1. Background

Introduction. The Sacramento-San Joaquin Delta is the outlet of a watershed encompassing more than half of California. It is located on the natural route between the San Francisco Bay Area (with access to the Pacific Ocean) and all points in the Delta watershed. Due to its flat terrain and its outlet nature, the Delta has evolved as the location for a diverse collection of infrastructure and utilities.

"Evolved" is a key concept. Utility development has occurred one step at a time, building on what happened previously. Individual agencies or service providers have made their independent, next-step decisions over many decades, based on their own needs, and consideration of their own costs and perceived risks. There is not and never has been a grand plan for utilities in the Delta.

"Perceived risk" is another key concept. Of course, flooding risk was recognized as a fact of life in the Delta. In response, there has been a long-standing effort to raise levees and enhance their effectiveness and reliability against high water from extreme tides and large flood discharges. As progress was made, many believed an acceptable degree of security had been achieved. However, for the first hundred plus years of Delta development, many risks were not recognized or were not perceived to be significant, at least on the time frame being considered for the next infrastructure or utility decision.

Land subsidence, multiple levee failures due to seismic activity, and climate change are only now being recognized as 'real' threats. However, even now, this may not have much effect on next-step infrastructure and utility decisions. Adding to this change in risk perception, the uses and degrees of dependence on utilities has also changed. Generally the consequences associated with failed utilities have increased and now may impact the regional or state economy.

The result is a Delta region that is a focal point for an inordinate amount of utilities assets that have diverse and increasing importance, including importance to the state as a whole. Also, these assets have vulnerabilities that are unusual and warrant special attention in the ongoing Delta risk assessment and future visioning efforts. There are two distinct types that must be recognized:

- Utilities that serve local needs.
- Utilities of regional or statewide importance, where the Delta serves as a corridor or activity center.

This distinction extends to other infrastructure located in the Delta that is addressed in other context memos – for example, transportation. Thus, parallel discussions could be provided to establish an overall infrastructure context. However, that broader perspective must be provided elsewhere.

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Iteration 1: June 22, 2007

The objective of this paper is to discuss the Delta with respect to (present and future) local, regional and statewide utilities, namely aqueducts, gas and petroleum-products pipelines, and electricity transmission. However, in some places, examples are given of "other" infrastructure where its inclusion improves the clarity and relevance of the discussion and gives it context.

Local Utilities in the Delta. Local infrastructure, utilities, and related private development in the Delta have evolved in the typical manner, with some additional constraints because of the Delta's soils, low-lying nature, and dependence on levees to protect usual land uses. As one would expect, local access roads have been created to connect to the state and federal highway systems. Electric power and telephone service are generally available throughout most of the Delta. Land use has been primarily agricultural, in order to take advantage of the rich organic soils and the easily accessible irrigation water in the Delta sloughs and channels, as facilitated by riparian and senior water rights.

Nonetheless, urban development pressure became noticeable in the later part of last century, especially at the edges of the Delta. With the desire to develop came the demands for higher levels of utility services – public water supplies, wastewater (sewage) services, solid waste disposal and increasing capacities and reliabilities for telephone and electrical services as well as local and arterial roads.

Concern over the long-term nature of the Delta and impacts of piecemeal growth and urbanization led to the Delta Protection Act of 1992 and to definition of the Delta Primary Zone (see Figure 1).

Under the Act, the Delta Protection Commission (DPC) has developed a long-term resource management plan for the Delta Primary Zone. The management plan prevents urban development and extensions of urban utilities in the Primary Zone unless they are already present or were permitted by zoning in 1992. However, the DPC has no authority to influence the provision of urban infrastructure or utility services in the Delta Secondary Zone, unless it finds a potential impact on the Primary Zone.

The development of utilities within the Secondary Zone is the responsibility of local planning agencies (county and city), and involves land owners, developers, utility agencies, and service providers.

Figure 1: Primary and Secondary Zones in the Delta-Suisun Area

Rapid urbanization is occurring in several locations including Oakley, Brentwood, Byron, Tracy, Lathrop, Stockton, Sacramento, and Fairfield (see Figure 2). In general, it is expected that the Secondary Zone will become fully urbanized over the next 50 to 100 years. Should this occur, local utility services will be made available for the entire Secondary Zone.

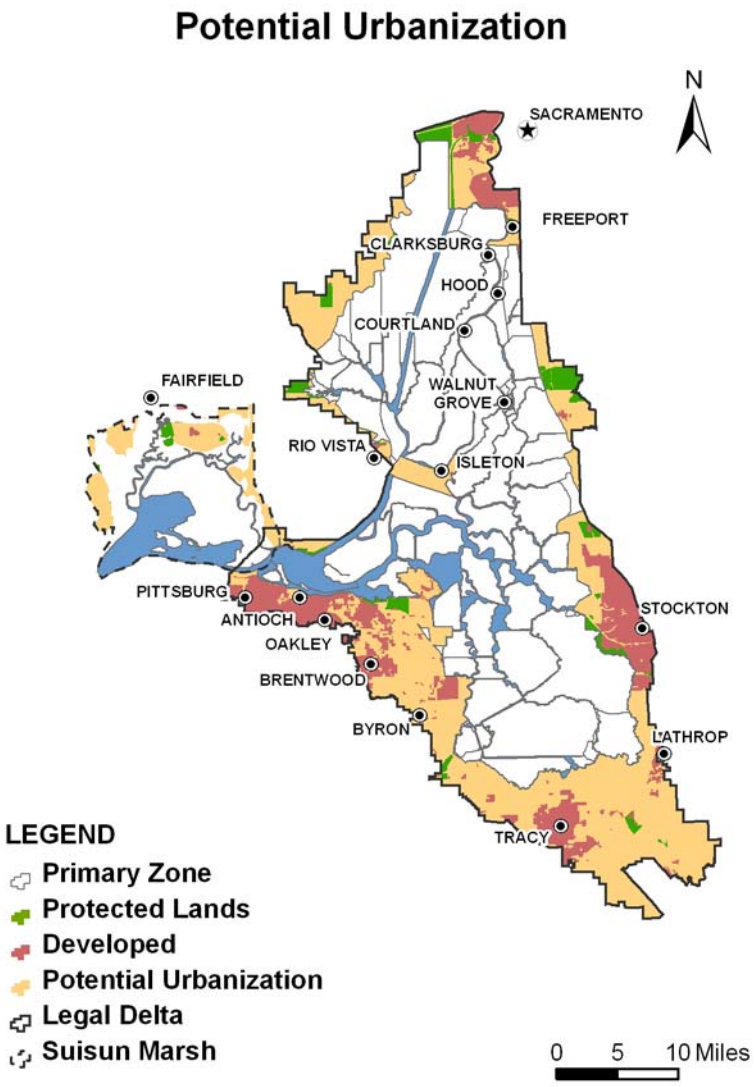

Figure 2: Potential Urbanization in the Delta-Suisun

Regional and Statewide Utilities in the Delta. Infrastructure or utilities that serve regional or statewide needs may be either of two forms – a linear facility that crosses or skirts the Delta or a major activity point located within the Delta (see Figure 3).

1

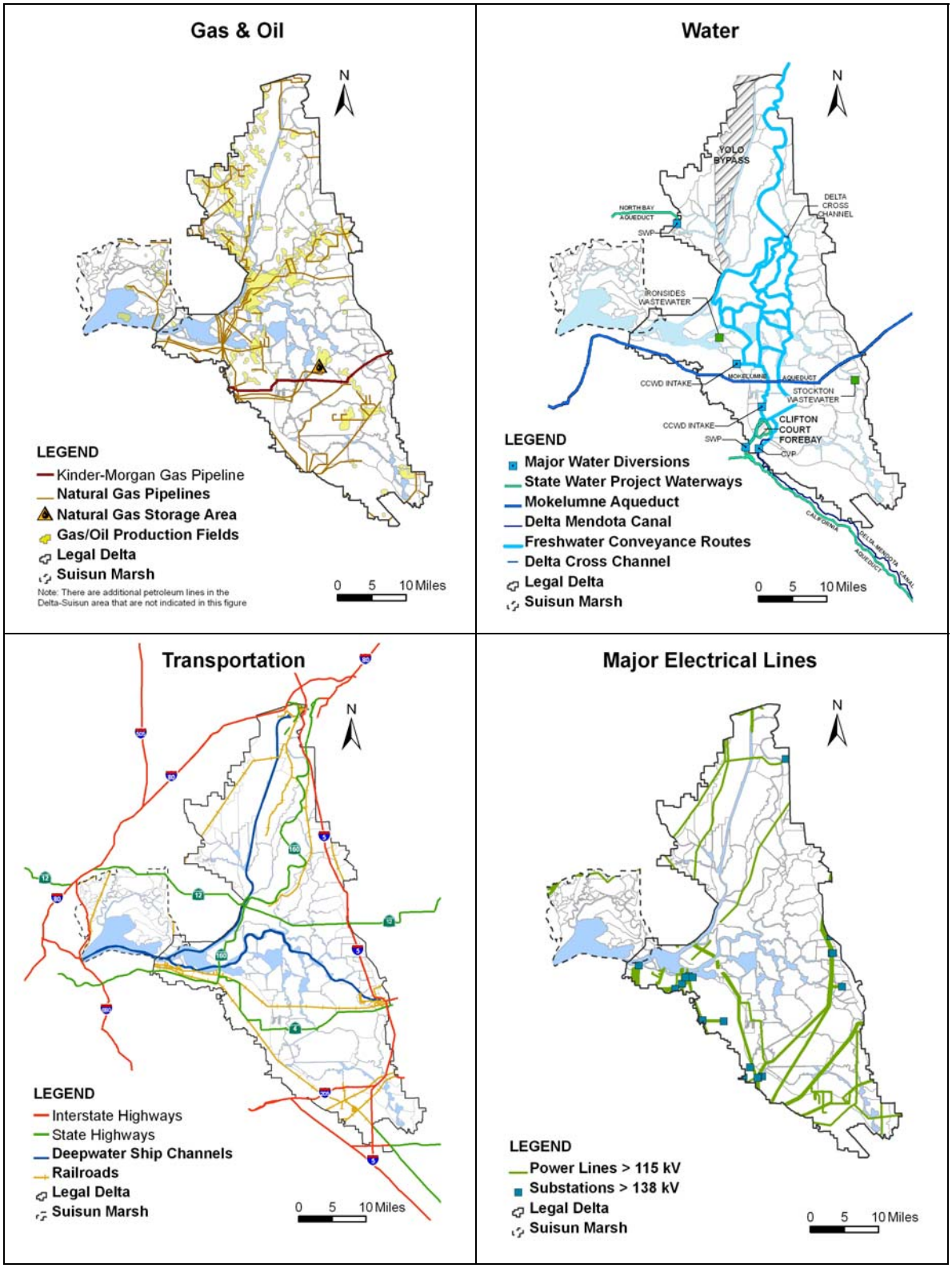

Figure 3: Overview of Utilities and "Other" Infrastructure in the Delta

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The following is a listing:

- Flood protection, control, and conveyance is a key infrastructure consideration in the Delta involving the natural river channels, the artificial Delta channels, the federal project and non-project levees, and established floodways such as the Yolo Bypass.
- The state and federal water projects use Delta channels to convey fresh water from the Sacramento River in the north Delta to their major pumping facilities located near Tracy in the south Delta and to the Contra Costa Water District pumps located nearby on or just adjacent to Old River. Two thirds of Californians obtain some of their water from these projects.
- The Mokelumne Aqueduct conveys water from the East Bay Municipal Utility District's (EBMUD) Mokelumne River source to its service area in Oakland and other parts of the East Bay. The three aqueduct pipelines convey approximately 90% of EBMUD's water supply to its service area.
- Important wastewater treatment facilities are located on Jersey Island, and on Roberts Island near Stockton.
- Petroleum pipelines convey gasoline and jet fuel from Bay Area refineries to Stockton, Sacramento and points east.
- Natural gas pipelines transect the Delta and Pacific Gas & Electric Company (PG&E) has a major (geologic formation) gas storage and retrieval facility located on McDonald Island (PG&E, 2006). On a peak winter day, natural gas from this storage location can supply as much as 20 to 25 percent of supplies needed in northern California.
- About 240 natural gas wells produce about 50 billion cubic feet of natural gas per year.
- Major electrical transmission lines transect the Delta, including three high-voltage, regional transmission lines of the Western Power Administration and PG&E.
- The listing could be extended for other infrastructure such as the interstate and state highways and other modes of transportation.

The Status and Trends for many of these regional/state utilities are discussed in Appendix A. Discussion of the state (State Water Project) and federal (Central Valley Project) is provided in the *Water Supply and Water Quality* context memorandum. Flood control infrastructure is detailed in the *Flooding and Delta Levees* context memorandum. Transportation modes and routes are detailed in the *Transportation* context memorandum.

Some infrastructure systems are very vulnerable to disruption and the consequences to the state may be extremely disruptive and expensive. Other infrastructure may have significant vulnerability, but potential consequences are less dramatic. Assessment of these vulnerabilities and consequences is the basic assignment for the Delta Risk Management Strategy (DRMS) Phase 1 risk analysis. Based on that assessment, opportunities to cost effectively manage the risks are to be identified in DRMS Phase 2.

Section 2. Conceptual Models and Related Science and Engineering

How Have Utilities Within the Delta Developed?

The siting of utilities within the Delta has occurred step by step, as a result of independent decision making by individual service providers over many decades, based on their own needs, and consideration of their own costs and perceived risks. Many utility owners are increasingly concerned about the security of their facilities, and therefore do not freely share specific information on facility sizes and locations. In addition, corporate owners are generally protective about their plans for future expansion.

In developing utilities, limited consideration appears to have been given to the regional and statewide importance of Delta area utilities, their special vulnerabilities due to the characteristics of the Delta, and the potential regional or statewide impacts of disruptions. Public agencies have only recently been required to conduct their planning efforts in a more open and transparent manner providing some opportunity for the public to understand and influence agency thinking on these topics. The degree to which regional and statewide risks and risk consequences are addressed in these processes is variable, and not necessarily related to the magnitude or importance of those risks.

Modeling of Hazards

To understand the risks to utilities and related infrastructure in the Delta, various techniques/tools/models have been developed to estimate the likelihood of a seismic or flood related event occurring and the associated consequence of failure.

The likelihood of seismic events is assessed using a probabilistic seismic hazard analysis to define plausible earthquake ground shaking events that could damage utilities directly, or alternatively, could initiate levee failures in the Delta. Similarly, hydrologic models are used to assess flows and water levels from floods of various frequencies. Structural models are then used to evaluate failure probabilities for levees and other facilities.

The likelihood of infrastructure or utility functional failures in the Delta is the combined likelihood of:

- Utility failure due to an earthquake or from flooding due to a levee failure caused by an earthquake;
- Levee failures due to a flood event; and/or
- A sunny day levee failure, which may result from increased levee fragility or loading (for example, reduced levee maintenance, rodent activity, land subsidence, extreme tides and/or sea level rise).
- The consequences of infrastructure and utility failures are largely social and economic. The methods and models available for evaluating these consequences are discussed in detail in the DRMS Phase 1 Economic Consequences Technical Memorandum (URS, 2007a).

Risks to Utilities

The best information presently available on risks to utilities in the Delta is the information recently assembled for DRMS. This project, which was authorized by the Department of Water Resources (DWR) in response to Assembly Bill 1200, assesses those risks associated with levee failure only. However, these are likely to represent a substantial proportion of the total risks to utilities within the Delta.

In some cases utilities within the Delta are buried pipelines that typically would not be damaged during flooding unless they were specifically located within the scour zone at a levee breach. Many of the above ground utilities (electric lines) would be above the flooding. Other utilities (substations and other ground based facilities) would be subject to flooding and would be damaged unless they were elevated.

The risks to utilities due to levee failure are summarized below, largely from the DRMS interim products including the Infrastructure Technical Memorandum (URS, 2007b) and the draft Risk Analysis Report (URS, 2007c). Additional detail is provided in Appendix A of this context memorandum. The distinction between local utilities and utilities of regional or statewide significance is maintained.

Utilities That Serve Local Needs in the Delta. Local utilities that serve areas of the Delta protected by levees and subject to flooding from levee breaches have all the risks associated with flood-prone areas. Normally (in other areas) these risks are due to rivers that occasionally rise above flood stage and the inundation recedes as the river flow decreases. In these typical situations, if a levee were damaged by an earthquake, there may be no inundation damage unless there happened to be a river flood at the same time. Throughout most of the Delta, where the vast majority of the land is below high tide elevations, the levees must work all year around. Thus, the risk is different; additional drivers such as earthquakes, high tides, or wind and waves can initiate the flood, so the opportunity for an event is increased. Also, when the breach event occurs,

the inundation is usually deeper and lasts longer. These factors are likely to increase the impacts on local utilities, the disruptions due to utility unavailability, and the costs and difficulties of repair and recovery. These risks are assessed in detail in the DRMS Infrastructure Technical Memorandum (URS, 2007b).

Electricity Transmission. In general, electricity-transmission lines are constructed above ground, making them less susceptible to damage caused by flooding. Transmission lines are likely to be vulnerable to earthquakes and scour damage, and electrical substations and other ground-based facilities would be subject to these risks plus the risk of inundation.

Loss of one or more of the 500 kV lines that cross the Delta during earthquake would probably not pose a significant additional cost to the state, other than the cost of repair. During such an earthquake, a number of electric system facilities would fail, and the 500 kV lines would likely be shut down to prevent the resulting system instability in the Bay Area from propagating up to the systems in the Northwest. PG&E believes that current operating rules mitigate against this worst case scenario.

Within the DRMS project, for a scenario where 30 islands are flooded, the consequences due to disruption of electricity transmission and delivery were estimated to be up to $20 million. This was due to loss of access to less expensive northwest power and reliance on less efficient local generation. No costs were quantified due to outages of local electricity generators.

Water Conveyance (Mokelumne Aqueduct). The Mokelumne Aqueduct consists of buried and elevated sections of pipeline through the Delta and has a number of river crossings. Buried aqueducts would generally not be vulnerable to inundation except where scour occurs. However, elevated aqueducts may be damaged if inundated.

About 90 per cent of the water supplied to EBMUD's 1.3 million customers is transported across the Delta via the Mokelumne Aqueduct. Any disruption to this aqueduct would have major implications for EBMUD's ability to supply water to its customers. In response to this vulnerability, EBMUD completed the Mokelumne Aqueduct Seismic Upgrade project, which reduced the vulnerability of their elevated pipeline structures to damage or collapse as a result of flooding from levee failure, intense earthquake shaking, and breaches at levee crossings.

EBMUD, San Francisco Public Utility Commission (SFPUC), and the City of Hayward have recently developed a regional partnership to connect their water systems and share water during an emergency or planned critical works on facilities. The "Water Intertie Project", which consists of a 1.5 mile pipeline, has the capacity to share up to 30 million gallons of water per day. To put this in perspective, the three Mokelumne

Aqueducts have a combined daily capacity of about 190 million gallons (EBMUD May 14th 2007 Daily Supply Report).

It is noted that EBMUD has emergency response plans for repairing its aqueduct underwater in the event that a pipe is damaged or ruptured. This should allow for the resumption of operations without prolonged disruption, because EBMUD would not need to wait for levee breach repair and island dewatering.

The elevated portion of the Mokelumne Aqueduct that was damaged during the June 2004 Jones Tract levee failure cost about $10.5 million to repair, for a length of 5¼ miles (URS 2005). In assessing the risk of levee failure to these assets, DRMS based its assessment of damage costs for this event. None of the three pipes was inoperable or shut down due to the Jones Tract event. Essentially all the damage was to the exterior coating.

Natural Gas Production, Storage, and Transmission. The majority of PG&E's gas transmission assets are buried at a depth of 5 feet or greater, which provides the greatest protection against flooding. However, at specific locations including levee crossings, PG&E pipelines are susceptible to the risk of floating during a flood event.

The most likely gas transmission disruption in the Delta would be due to a levee breach that leads to inundation and scouring. Scouring could result in variable degrees of damage, depending on where the pipeline is located relative to the levee breach. If the pipeline is located in an area of less intense scour, the soil cover would be removed, and natural gas pipelines would float. By reducing operating pressures and by anchoring the floating pipeline, PG&E would generally prevent the pipeline from rupturing in this case. However, in the event of substantial scouring along or across the pipeline's route suspending the pipe in the scour hole, the unsupported pipe would likely rupture.

Gas and oil production fields, natural gas wells, and natural gas storage and recovery facilities are less likely to incur damage due to inundation (without scour). The gas wells on the islands can be shut down if flooding is impending, and most should not be damaged. However, PG&E has indicated that inundation of its natural gas storage and recovery facility on McDonald Island for several months would interfere with needed ongoing maintenance projects. These could not be conducted under water, so the facility would need to cease operation.

For a scenario where 30 islands are flooded, depending on the time of the event and type of season, DRMS estimated costs to PG&E for natural gas transmission and storage at between $0.9 and $1.4 billion. These consequences are attributed primarily to lack of the ability to maintain the McDonald Island storage facility and loss of its availability for winter-time augmentation of northern California's natural gas supply.

Fuel Transmission. Fuel pipelines are generally around 4 feet below the soil surface, and have remote electronic valves so they can be shut down rapidly in times of emergencies. They also have an operating practice of pumping out fuel and filling with water if the pipeline site is flooded (URS 2007b). This keeps the lines weighted and minimizes spill in case of rupture.

Within the DRMS project, the losses from gasoline, diesel, and aviation fuel transmission were assumed minimal because the products were assumed to be shipped by truck in event of pipeline disruption. Thus, much of any additional costs would be in the form of transfers of wealth from gasoline buyers to trucking firms and gasoline supply companies, rather than a reduction in overall economic activities (URS 2007a).

Wastewater Facilities. Flooding will disrupt wastewater operations and could result in partially treated discharges to waterways, the contamination of drinking water and the liabilities that such an event would ensue. As breach repair and dewatering occurs, repair of wastewater facilities and resumption of operations should proceed over reasonably short timeframes. However, some wastewater facilities may be out of operation for considerable periods awaiting breach repair and island dewatering.

Other Infrastructure. For comparison, and to give the overall context for utilities, it is useful to consider briefly similar information about other types of infrastructure. For example:

- *Interstate highways*[1] are located on the periphery of the Delta and usually incorporate a raised roadbed. If interstate damage or disruption were to occur during a levee breach event, it is likely that it would be localized and could be accessed from one or both sides of the damage for expedited repair.
- *State highways*[1] that cross the Delta (4, 12, and 160) have sections that are below sea level and would be flooded if those particular islands experienced levee breaches. They would be impassable until the levee breaches were repaired and the island dewatered. This disruption could last several months and would increase travel times and costs. In the DRMS Phase 1 risk analysis, state highway disruption was found to be a significant cost item with estimates ranging up to $1.8 billion in the case where 30 islands were flooded.
- *State and federal water projects*[2] depend on maintaining fresh water in Delta channels to convey Sacramento River water to the projects' south Delta pumps for export to the Contra Costa Water District, parts of the East Bay and South Bay, the San Joaquin Valley, the central coast, and southern California. If a levee

[1] The Transportation context memo provides details.
[2] Details are provided in the Water Supply and Water Quality context memo and in the DRMS Phase 1 Risk Analysis Report (URS, 2007b)

breach event occurs during low flows and floods multiple islands, salty water from Suisun and San Pablo Bays can be drawn into the Delta to flood the islands and contaminate the Delta channels with salinity that is unacceptable for pumping. In the DRMS Phase 1 Risk Analysis, these disruptions were found to have substantial consequences for the state's economy, with "costs" ranging up to $16 billion and with "impacts" ranging up to $52 billion for the case where 30 islands were flooded during a dry period.

- *Delta levees flood control facilities*[3] are particularly important in considering flooding risks in the Delta and they may sustain extensive and extremely expensive damage, not to mention the other damage caused by their failure. In the DRMS Phase 1 Risk Analysis, just the cost of levee repairs was estimated to be up to $8.4 billion in the case where 30 islands were flooded.

Science and Engineering

Utilities independently assess the risks to their businesses and mitigate these risks where they deem necessary. Often this reflects the particular portion of risks or reliability that the utility is familiar with considering. There may be other risks that simply do not receive attention. For example, it seems that PG&E conscientiously considers pipeline design and reliability risks. However, they do not appear to have a contingency plan if the McDonald Island gas storage facility is unavailable for a prolonged time due to inundation.

One such pipeline reliability investment is the recent decision by PG&E to build redundancy into their natural gas pipelines from the McDonald Storage Field. A third pipeline – 57C, is being constructed alongside pipeline 57A and pipeline 57B to reduce the risk of a disruption to supply and associated lost revenue where existing pipelines are damaged. This new pipeline is due to come on line in 2007 (PG&E, undated).

Utility owners increasingly use improved construction methods and materials to reduce the likelihood of disruption to their services during seismic or flood event including. These methods include increasing the flexibility of pipeline, joints, and fittings in the case of ground movement; exploring a range of trench-less construction methods; and using corrosion resistant materials (e.g., polyvinyl chloride [PVC] and high density polyethylene [HDPE]).

[3] Details are provided in the Delta Levees and Flooding Context memo and in the DRMS Phase 1 Risk Analysis Report (URS, 2007b)

Techniques used buy PG&E to reduce pipeline risks in the Delta include:

- Designing critical equipment so that it is located on storage platforms above flood levels;
- Concrete coating or other anchoring technique to reduce the risk of pipelines floating;
- The use of trench-less high density drilling at river crossings;
- The use of valves to cut off gas if flooding occurs; and
- Using a concrete water-break-wall on the crown at levee crossings to prevent water channeling along pipelines.

PG&E designs and builds electric transmission lines to withstand effects of wind, temperature, and ice when applicable. The effect of the temperature and loading conditions are more stringent on the structures and foundations than the effects of an earthquake.

Occasionally, a regulator (e.g., the Public Utilities Commission) may require a utility to consider the regional or statewide risk and reliability of its facilities. Such work specifically focused on Delta infrastructure has likely been limited to consideration of individual facility failures resulting from any, unspecified cause – not specifically considering multiple island levee failures that may impact multiple facilities.

Note that little effort has been expended in the past to characterize the regional or statewide significance of overall Delta infrastructure and utility risks. The DRMS project is a first attempt to comprehensively assess the aggregate risk of levee failures to Delta utilities. This is a new application of the scientific and engineering tools assembled in other fields to perform probabilistic risk analyses.

Summary

The consideration of Delta utilities to this point is summarized as follows:

- Many infrastructure and utility assets have been sited in the Delta as the understandable result of independent, step-by-step decision making by diverse service providers over many decades.
- It is important to distinguish between utilities that serve local areas of the Delta and other utilities that have regional or statewide importance or impacts.
- For utilities serving local areas, the main issues are the extent and duration of local flooding and the cost of repairs for resumption of services.

- Many regional/statewide utilities could be repaired expeditiously if they were impacted by flooding due to levee breaches.
- The main regional/statewide utilities that could experience prolonged disruptions in a major Delta levee breach event are:
- PG&E's McDonald Island gas storage facility and/or associated pipelines may be out of service for a prolonged period, depending on the schedule for repairing McDonald Island levees, dewatering the island, and subsequent repairs required to rehabilitate the facility.
- Wastewater facilities that serve communities surrounding the Delta, such as those on Jersey and Roberts Islands will also be out of service until their islands are repaired and dewatered.
- In the event that one or more of EBMUD's Mokelumne Aqueduct pipelines become damaged and inoperable, the water supply of for 1.3 million customers could have considerable short-term impacts – until EBMUD has implemented repairs that may need to be performed under flooded conditions. Such repairs could be complicated by ruptures located at deep scour holes.
- In considering the overall significance of these regional utilities disruptions, one would need to consider their context by comparing with other infrastructure, particularly the state and federal water projects, the Delta levee flood control system, and the state highways crossing the Delta.

Section 3. Policies

Introduction

Policies regarding utilities in the Delta are complex. Those that exist are difficult to describe clearly and great care is needed to articulate their diverse manifestations. New policies that are proposed are even more difficult because they tend initially to be stated simply and, thus, may not consider the full range of implications that could result. This leads to contentious and volatile discussions.

In the interest of clarity and to avoid unneeded contentious discussion, this consideration of policies will address distinct categories of Delta utilities. The following categories will be used:

- Local utilities in the Primary Zone
- Local utilities In the Secondary Zone
- Utilities already installed or serving land uses already established

- Utilities that extend service areas or convert land to more intensive uses (usually urban residential, commercial or industrial)
- Regional or statewide utilities in the Delta

With respect to each of these categories, each pertinent level of government either articulates policy or, though inaction, creates a de facto policy. In general the policies have one of three effects:

- Encouragement of a particular direction or orientation of utility management and development;
- Tolerance or allowance of utility guidance and decision making by others; or
- Discouragement of particular directions of utility management and development.

The following discussion will identify the explicit or apparent policies of each pertinent level of government and then indicate potential courses for future policy, concentrating on a State of California viewpoint as it may be relevant for creating a Delta Vision.

Policies Regarding Local Infrastructure and Utilities in the Primary Zone

The Delta Protection Act of 1992 is the primary regional policy affecting local infrastructure and utilities in the Delta. It created the Delta Protection Commission, defined the Delta Primary and Secondary Zones, and mandated development of a long-term resources management plan for the Primary Zone. The plan seeks to limit development in the Primary Zone. This includes protecting the Delta from excessive construction of utilities, including those that support uses and development outside the Delta. Where construction of new utilities is appropriate, the plan is intended to ensure that the impacts of such new construction on the integrity of levees, wildlife, and agriculture in the Primary Zone are minimized. Additional details are provided below.

The Delta Protection Act of 1992 declared that the basic goals of the state for the Delta are the following:

- Protect, maintain, and, where possible, enhance and restore the overall quality of the Delta environment, including, but not limited to, agriculture, wildlife habitat, and recreational activities.
- Assure orderly, balanced conservation and development of delta land resources.
- Improve flood protection by structural and nonstructural means to ensure an increased level of public health and safety.

The Delta Protection Act of 1992 required the Delta Protection Commission (DPC) to complete a regional land use plan for the Delta. The *Land Use and Resource*

Management Plan for the Primary Zone of the Delta was developed in 1995 and subsequently revised in 2002. A key purpose of the Plan was to provide local planners with guidelines to use in considering the cumulative impacts of individual land-use decisions on resources (such as: agricultural viability, fisheries, recreation, and water quality) in the Delta region. In addition, the Act gave DPC review and appeal authority should local decisions contradict the adopted regional plan.

The specific goal of the Land Use and Resource Management Plan with respect to utilities was to:

> *Protect the Delta from excessive construction of utilities and infrastructure facilities, including those that support uses and development outside the Delta. Where construction of new utility and infrastructure facilities is appropriate, ensure the impacts of such new construction on the integrity of levees, wildlife, and agriculture are minimized.*

The four policies that were adopted for utilities were:

1. Minimize the negative environmental and social impacts for new the construction of transmission lines and utilities;
2. Provide new potable water and wastewater facilities for new housing developments that do not overburden the supply of these services to existing residents ;
3. Locate new sewage treatment facilities (including storage ponds) and new areas for disposal of sewage effluent and sewage sludge outside the Delta Primary Zone; and
4. Minimize solid waste production and locate disposal facilities outside the Delta Primary Zone, but where they can be easily accessed by Delta residents, visitors, and businesses.

More information on each of these policies is provided in the shaded box below.

P-1. Impacts associated with construction of transmission lines and utilities can be mitigated by locating new construction in existing utility or transportation corridors, or along property lines, and by minimizing construction impacts. Before new transmission lines are constructed, the utility should determine if an existing line has available capacity. To minimize impacts on agricultural practices, utility lines shall follow edges of fields. Pipelines in utility corridors or existing rights-of-way shall be buried to avoid adverse impacts to terrestrial wildlife. Pipelines crossing agricultural areas shall be buried deep enough to avoid conflicts with normal agricultural or construction activities. Utilities shall be designed and constructed to minimize any detrimental effect on levee integrity or maintenance.

P-2. New houses built in the Delta agricultural areas shall continue to be served by independent potable water and wastewater treatment facilities. Uses which attract a substantial number of people to one area, including any expansions to the Delta communities, recreational facilities or businesses, shall provide adequate infrastructure improvements or pay to expand existing facilities, and not overburden the existing limited community resources. New or expanded construction of wastewater disposal systems shall ensure highest feasible standards are met, as determined by the local governing body. Independent treatment facilities shall be monitored to ensure no cumulative adverse impact to groundwater supplies.

P-3. New sewage treatment facilities (including storage ponds) and new areas for disposal of sewage effluent and sewage sludge shall not be located within the Delta Primary Zone. The Rio Vista project, as described in the adopted Final Environmental Impact Report for such project, and the Ironhouse Sanitary District use of Jersey Island for disposal of treated wastewater and biosolids are exempt from this policy.

P-4. High groundwater tables and subsiding soil make the Delta an inappropriate location for solid waste disposal. Generation of waste shall be minimized through recycling programs for metals, glass, paper, cardboard, and organic materials. Recycling depots for these materials shall be located in central locations to serve Delta residents, visitors, and businesses.

Source: http://www.delta.ca.gov/plan.asp

County General Plans. The five counties that govern land within the Delta Primary Zone are Contra Costa County, Sacramento County, San Joaquin County, Solano County and Yolo County. Alameda County has a small area within the legal Delta, but it is not part of the Primary Zone. Californian state law requires each of these counties to prepare and adopt a General Plan (§65300), which documents the overarching vision, goals, objectives and policies to guide future physical development of the County and any land outside its boundaries which bears relation to its planning (OPR 2007).

Counties develop policies for seven (7) mandated elements (§ 65300 et seq.), such as Land Use, Circulation, Housing, Conservation, Open Space, Noise and Safety and

other elements, as determined necessary by each local jurisdiction. Of particular relevance to this context memorandum is the planning for water and wastewater facilities within the Delta. County policies must be consistent with their statutory requirements and the overarching state policies developed by the DPC for the Primary Zone. Further information on the specific nature of these policies can be found on each County web site.

New State Policies for Local Infrastructure and Utilities in the Primary Zone. Through the Delta Protection Act, the state has made a commitment to preserve the basic agricultural, wildlife habitat, and recreational character of the Delta, and has also recognized that the cities, towns and settlements that already (in 1992) exist in the Delta Primary Zone are of significant historical, cultural, and economic value and that their continued protection is important to the economic and cultural vitality of the region. Assuming that this overall policy is to continue, the following state policy questions/initiatives could be considered:

- Should legacy communities in the Delta Primary Zone (as of 1992) and their associated infrastructure and utilities receive upgraded protection from the risks of levee breach flooding?
- Should this upgraded protection for Delta legacy communities be in the form of ring levees built to a higher standard than typical Delta Levees?
- If better levees are to be provided, what standard should pertain? FEMA standards? DWR urban levee standards? Some seismic capability standard? And what financial aid should be provided?
- Should special standards for Primary Zone legacy-community infrastructure and utility construction be implemented (and supported financially)? These would pertain to infrastructure and utility maintenance and essential upgrades, in order to reduce infrastructure flooding damage and facilitate recovery after flooding occurs.
- What policy and program (including financial assistance) should the state have for assisting with Delta Primary Zone legacy-community (infrastructure and utilities) recovery after flooding occurs?
- How should the state address liability issues (e.g., the Paterno Decision) as it pertains to local infrastructure and utilities in the Primary Zone?

Policies Regarding Local Utilities in the Secondary Zone

There is no special state or regional policy pertaining to existing or proposed local utilities in the Delta's Secondary Zone. The one exception is that the Delta Protection

Commission has authority to comment on Secondary Zone plans for new installations if the Commission can establish that the plan would have an impact on the Primary Zone.

As long as levees protect low-lying areas from the 100-year flood, full urban development including all the relevant utilities is permitted to occur in the Secondary Zone. Note that with a "100-year" levee, the probability of experiencing an event exceeding the levee's design capability is 1% each year, or during a 30-year exposure period, the probability is 26%.

New State Policies for Local Utilities in the Secondary Zone. Policy issues/questions similar to those listed above are also relevant to the Secondary Zone, but the answers are not necessarily the same. Furthermore, one must distinguish between development that is already present and areas that are not yet developed but are likely to be.

For areas in the Secondary Zone that are already developed:

- Should these existing communities and their associated utilities receive upgraded protection from the risks of levee breach flooding?
- Should this upgraded protection be in the form of levees built to a higher standard than typical Delta Levees?
- If better levees are to be provided, what standard should pertain? FEMA standards? DWR urban levee standards? Some seismic capability standard? And what financial aid should be provided, if any?
- Should special standards for Secondary Zone infrastructure and utility construction be suggested in order to reduce infrastructure flooding damage and facilitate recovery after flooding occurs? Should financial support be provided?
- What policy and program (and what financial assistance, if any) should the state have for assisting with Delta Secondary Zone community (utilities) recovery when flooding occurs?
- How should the state address liability issues (e.g., the Paterno Decision) as it pertains to local utilities in existing Secondary Zone communities?

Finally, for Secondary Zone areas that are not yet developed but may experience development pressure, one must start with a special policy question/issue:

- Should development (and associated utilities) in these areas be discouraged or prohibited?
- If development is to be allowed, one must then address issues similar to those posed above. But, in this case, it is likely more attention will be devoted to having

developers and local agencies shoulder the costs and to making certain that prospective purchasers are adequately informed of the risks.

Policies Regarding Regional and Statewide Utilities in the Delta

The Delta Protection Commission has authority to consider impacts of regional and statewide utilities on the Primary Zone and require new projects to be consistent with the Primary Zone *Land Use and Resource Management Plan*. However, there is no unified policy addressing the management of existing or installation of new utilities that have regional or statewide significance and that are located in the Delta. In particular, there is not a policy that requires consideration of regional or statewide impacts in light of the unique risks associated with the Delta. To the extent that such impacts are considered, they are addressed in EIS/EIR and other regulatory processes in the form of normal considerations of flooding and emergencies within individual functional areas, namely: electrical generation and transmission, natural gas facilities, telecommunications, and so forth. In some cases, normal consideration of flooding vulnerability may be none or cursory.

New State Policies for Regional and Statewide Utilities in the Delta. Through Delta Vision, the state has the opportunity to consider the potential disruption to regional and statewide utilities that may occur. It can then decide whether those risks (including costs of repairs) are acceptable. If policies are needed for reducing risk exposure from regional and statewide utilities, various approaches are available.

- Harden existing infrastructure and include provisions for future enhancements and capacity increases (e.g., a utility corridor, possibly including allowances for more railway tracks, more hydrocarbon pipelines, more water aqueduct pipelines, and an elevated roadway).
- Harden existing infrastructure but don't allow future enhancements or capacity increases.
- Maintain and reasonably protect/repair what is already there, but direct new utilities and capacity increases or major upgrades of existing utilities to locations that are less vulnerable.
- Include the strategy of relocating existing regional/statewide infrastructure to less vulnerable locations.

A mixture of these approaches may be selected based on their cost effectiveness for reducing risks. Whatever strategy is formulated, key issues will include financing and liability. For example, if an east-west corridor were desired and it provided benefits to the railroad and to PG&E's gas infrastructure, would the state expect these companies to contribute to the financial support of the project? Would the companies do so? If there were a damaging levee breach anyway, would the companies sue the state for damages (per the Paterno ruling)? Consider that the railroad is now litigating against the state to

recover its damages in the Jones Tract levee breach incident. Or, would these companies be expected to forego such litigation as a condition of their benefiting from the improvements?

Flood Management Planning and Emergency Response

The one over-arching policy area that is relevant to all discussion of Delta infrastructure/utilities policy within the Primary and Secondary Zone is the present state/federal policy on flood management and associated emergency response. There are two distinct and contrasting policies in place for the Primary Zone and the Secondary Zone.

1. Primary Zone

The Delta Protection Act and the resulting resource management plan for the Primary Zone discourage new local utilities where they would extent or upgrade land uses or residential development outside existing communities or beyond authorized zoning and densities already in place as of January 1, 1992. New non-agricultural residential development, if needed, must be located within the existing Primary Zone communities where support infrastructure and flood protection are already provided. It is interesting that the stated reason for this policy is to protect or enhance the traditional Delta land uses of agriculture, wildlife habitat, and recreation. An unstated additional motivation may be avoidance of potential flood damages.

2. Secondary Zone

In the Secondary Zone, special (regional, state or federal) Delta policies related to flood potential are not articulated. The general state and federal flood management and emergency response policies apply, oriented primarily to definition of the 100-year flood plain, as minimized by protective levees.

- Local agencies are responsible for land use and associated local infrastructure/utilities policies. The usual local policy is that low land that is protected by levees at least for the 100-year flood is “not in the floodplain” and full urban development is permitted. There is little, if any mention that such land will likely be flooded in a larger event, and such a larger event has a 26% probability of occurring within 30 years.
- Normal EIS/EIR requirements apply to regional or statewide utility projects and Delta flooding vulnerability and regional or statewide economic and social consequences may or may not receive careful attention.

When a flooding event occurs, the state and federal governments provide recovery assistance under their normal national or state emergency programs, provided certain minimum protection requirements have been met. Funding is provided for the repair of both local utilities and regional or statewide infrastructure. Thus, the state and federal

policies provide assistance without knowing whether the Delta's special flood vulnerability has been appropriately considered in investment decision making.

Some might argue that this state/federal policy actually encourages infrastructure and utility development in vulnerable Delta locations. This encouragement occurs in an indirect and unintended way because of the recovery aid provided when the predictable flood damage occurs. The risk has been artificially reduced for the people or institutions who might otherwise take responsibility for avoiding exposure.

Overall Delta Infrastructure and Utility Policies

The following overall infrastructure and utilities policy issues for the Delta are identified:

- Is the existing state/federal policy on Delta-area flood management and associated emergency response relative to utilities appropriate for the future?

  The existing flood management policy for utilities is described immediately above. Except for the Delta Primary Zone, the policy is simply an extension of the typical nation-wide, 100-year flood plain policy. It does not recognize the all-year vulnerability of low land behind Delta levees, nor does it recognize the extra vulnerability due to subsidence, seismicity, sea level rise and the increasing frequency of floods.

- Is there a need for a comprehensive infrastructure plan (or policy, or strategy or guideline) for the Delta?

  Infrastructure and utility development in the Delta has evolved one step at a time, over many decades, building on what happened previously. Individual agencies or service providers have made their independent, next-step decisions based on their own needs, the needs of their immediate client base or stakeholders, and consideration of their own costs and perceived risks. Regional and statewide risks and potential impacts have typically not been considered or been considered as an afterthought in an uncoordinated way. Cumulative risks are now being addressed for the first time.

- How should changing risks, risk perceptions, and regional and statewide infrastructure and utility risks be considered?

  Flooding risk has always been recognized as a fact of life in the Delta. In response, there has been a long-standing effort to raise levees and enhance their effectiveness and reliability against high water from extreme tides and large flood discharges. As progress was made, many believed an acceptable degree of security had been achieved. However, for the first hundred plus years of Delta development, many risks were not recognized or were not perceived to be

significant, at least on the time frame being considered for the next infrastructure or utility decision.

Land subsidence, multiple levee failures due to seismic activity, and climate change are only now being recognized as 'real' threats. However, even now, this may not have much effect on next-step infrastructure and utility decisions. Adding to this change in risk perception, the uses and degrees of dependence on utilities has also changed. Generally the consequences associated with failed utilities have increased and now many reach far beyond the service provider – and may impact the regional or state economy.

The question remains as to how these risks should be considered moving forward.

Concluding Comments

The State's existing exposure and tolerance of risks to local, regional, and state utilities within the Delta must be individually considered. Damages to local utilities are significant, but these direct damages are only part of the losses for the local communities impacted. The regional/statewide utility items that now appear to generate the largest consequences are disruption to EBMUD's Mokelumne Aqueduct (if ruptured by direct scour), disruption of PG&E's McDonald Island gas storage and retrieval facility by prolonged flooding and, possibly, prolonged flooding of wastewater facilities on Jersey and Roberts Islands.

Beyond this, the state must decide whether it is willing to allow the ever-increasing risk exposure represented by new and upgraded utilities investments in the Delta. And, if such investments are to go forward, should they be subject to special policy conditions to lessen or mitigate risks? Both in the urbanizing Secondary Zone and for utilities with regional and statewide significance, present policies and trends indicate increasing investments that will be subjected to increasing likelihoods of floods and earthquakes and will result in increased levels of future consequences. This policy debate can be summarized in the following questions:

- Is increased risk exposure from future Delta infrastructure investments the right future for the state's financial position? Can this risk be adequately mitigated?
- Is increased risk exposure the right future for the state's communities and citizens who might live with the increased risks (e.g., in the Secondary Zone)? Can this risk be adequately mitigated?
- Is increased risk exposure the right future for the region's and the state's economy? Can this risk be adequately mitigated?

Searching for a reasonable future vision of Delta utilities that will be broadly acceptable to stakeholders and the state's citizens is a formidable task.

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