Working Paper for Proposed WSIP
Common Assumptions and Recommendations – Physical Changes

DRAFT

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1 Introduction and Purpose

This paper is a working draft of proposed Common Assumptions, recommendations and other information to be used in calculating physical changes with any proposed Water Storage Investment Program (WSIP) project. The primary purpose is to develop a set of requirements to support the generation of the most current, complete, consistent and easily comparable information for WSIP grant applications. The proposed Common Assumptions are presented for both General (Section 4) and specific project conditions by key Resource Areas (Section 5), with recommendations to further assist proposal preparation.

This draft document is a work-in-progress for the purpose of generating discussion and feedback from the Stakeholder Advisory Committee (SAC). The proposed Common Assumptions and recommendations will continue to be developed and refined.

2 Background

As required by the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Act), the California Water Commission (Commission) must consider a wide range of proposed projects that may be eligible for funding including (§79751):

- Surface storage projects identified in the CALFED Bay-Delta Program Record of Decision;
- Groundwater storage projects;
- Groundwater contamination prevention or remediation projects with water storage benefits;
- Conjunctive use projects;
- Reservoir reoperation projects;
- Local surface storage projects that improve the operation of water systems in the state and provide public benefits; and
- Regional surface storage projects that improve the operation of water systems in the state and provide public benefits.

The Act requires the Commission to rank projects based on the expected return for public investment as measured by the magnitude of public benefits provided by the projects (§79750(c)). The Commission is also required to develop and adopt methods for quantification and management of public benefits (§79754).

2.1 Role of Common Assumptions

Common Assumptions are requirements to be used by project applicants and evaluators to ensure that expected benefits and costs are expressed completely and consistently and the results are comparable across projects. Common Assumptions require applicants to provide sufficient information to:

1) Define future conditions without project;
2) Assess future conditions with project;
3) Calculate physical changes created or caused by the project;
4) Calculate benefits and impacts spread over the life of the project;
5) Compare present value of benefits and costs; and
6) Allocate costs to beneficiaries.

This document discusses the Common Assumptions, recommendations and the potential for incorporating other information to support calculating physical changes (steps 1 through 3). The Common Assumptions for economic evaluation (steps 4 through 6) are discussed in the companion document: *Working Paper for WSIP Common Assumptions – Economics*.

Use of Common Assumptions will support the Commission in:

- Determination of how a water storage project may improve operation of the system (§79750(b));
- Comparison of potential improvements for projects with benefits in the same area (§79750(c));
- Determination of "net" and "measurable" improvements (§79750(b) and §79752);
- Accounting of benefits and costs – ensures calculations are complete and considers all potential physical changes (§79750(a)); and
- Implementing assurances for providing public benefits managed over time (§79754).

2.2 Role of Metrics

The evaluation and comparison of multiple projects requires a current, complete and consistent set of metrics for reliable comparison and ranking of projects. Metrics are the quantified values of physical factors representing project conditions, such as diversion, storage, water flow and temperature by location and time. Metrics are based upon specific formulation methods (calculations, modeling, etc.) used to determine expected physical changes, benefits and impacts as well as monetization of net benefits and costs. The usefulness of a metric depends on which datasets and methods are employed, and consistency with those adopted and in use by the agencies responsible for administering the public benefits, including State Water Resources Control Board (State Water Board), California Department of Fish and Wildlife (DFW), and Department of Water Resources (DWR).

Metrics are used for quantifying physical changes and benefits and impacts associated with a project, including the specific public benefits as defined in the Act (§79750(c)):

- Ecosystem improvements;

- Water quality improvements;
- Flood control benefits;
- Emergency response; and
- Recreational purposes.

Metrics are important to understand how a project will be operated in the context of ongoing and planned operations of the State Water Project (SWP) and Central Valley Project (CVP) and operations of the facilities of local water agencies and water rights holders.

2.3 Calculating Benefits and Impacts using With and Without Project Conditions

The benefits and impacts of a proposed project are determined by the differences between the with and without project conditions. **Table 1** lists the important resource areas for quantifying physical changes and benefits and impacts.

Proposed surface storage, groundwater, conjunctive use, and/or reservoir re-operation projects will directly modify surface water operations in some way. New operations in one location will likely interact and influence the physical movement of water and operations in other parts of the water resources system including: main stem rivers, tributary watersheds and the Sacramento – San Joaquin River Delta (Delta). Changes in flow, water quality, salinity, etc., will directly impact water-dependent resources such as aquatic and terrestrial wildlife species, energy production and recreation resources. Complete water balance analyses for both the with and without project conditions are required, and they must be compared to show how the project will affect flows, storage and water deliveries. A clear linkage between a proposed project, its operations plan, and the expected physical changes is also fundamental to determine benefits and impacts in a complete, consistent and comparable manner.

Table 1: Operations, Physical Conditions and Resource Areas.

Operations	Physical Conditions	Resource Areas
Surface water	Riverine	Aquatic biological
Groundwater	Delta	Terrestrial biological
	Surface water quality	Energy
	Groundwater quality	Recreation
		Economic

Figure 1 depicts the linking of Common Assumptions, methods (calculation/modeling for the resource areas), and metrics (physical changes and economics) for the analysis of a proposed project. The analysis includes:

- Determining expected physical changes; and
- Using sensitivity analysis to understand how sources of uncertainty (e.g., climate change and sea level rise) may affect expected physical changes.

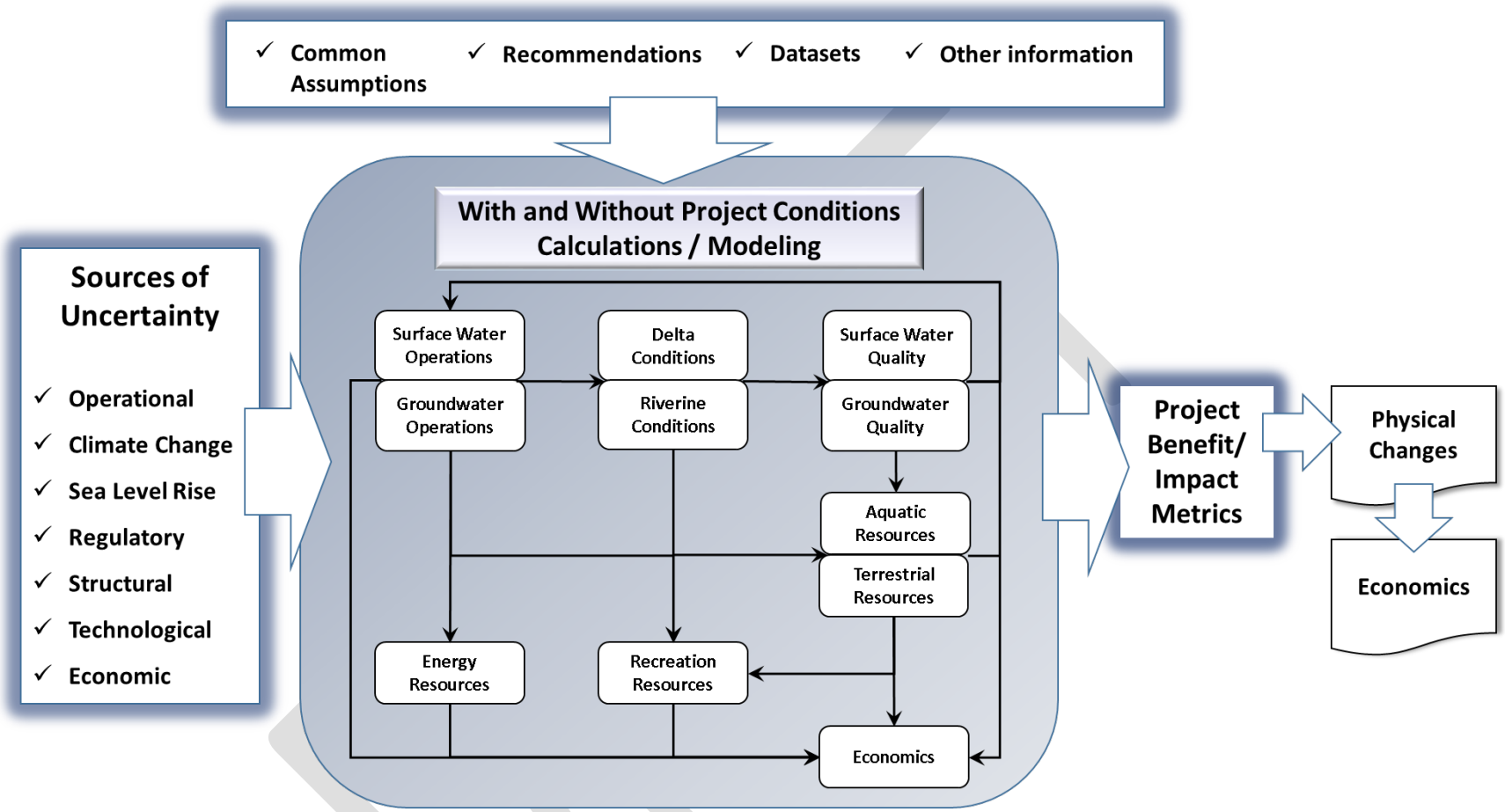

Figure 1. Linking of Common Assumptions, Methods and Metrics

2.4 Information Provided by Applicants

As part of the information included with their WSIP application, an applicant will provide documentation of their analysis of expected changes created or caused by a proposed project.

For the analysis of expected physical changes, the applicant will provide documents, datasets, methods and results for describing and quantifying the without project condition, the with project condition and calculating the expected physical changes created or caused by the project (differences between with and without project conditions).

For sensitivity analysis of sources of uncertainties that may affect expected physical changes, the applicant will provide any datasets, methods and results that are modified for the uncertainty under consideration and calculated differences in expected physical changes between the sensitivity analysis and the analysis of expected physical changes.

3 Definitions

The following definitions are used in this document. These are in addition to other definitions included in other working draft documents that are being developed by the WSIP team:

- **Common Assumptions** – requirements for with and without project conditions, methods, and metrics that must be used by all applicants and required for evaluation of proposed projects.
- **Recommendations** – non-mandatory technical guidance regarding with and without project conditions, methods, and metrics to support all applicants in meeting Common Assumptions.
- **Physical change** – an expected change in: surface water and groundwater operations; Delta and riverine conditions; surface water and groundwater quality; aquatic and terrestrial biological resources; energy resources; recreation resources; or other resources affected by the change in diversion, storage or flow of water in the water resources system created or caused by a proposed project.
- **Without project conditions** – a generally accepted quantitative and qualitative description of the water resources system without the proposed project that provides the basis for evaluating physical changes.
- **With project conditions** – a quantitative and qualitative description of the water resources system with the proposed project; based on the without project conditions and including additions or modifications specific to the proposed project description and operations plan.
- **Metric** – a quantitative or qualitative measure of physical change between with project and without project conditions; each metric is specific to a type of physical change considering location, time period, units and other attributes.
- **Datasets** – inputs to methods or metrics derived from assumptions or reference data sources.
- **Method** – a quantitative, qualitative or combined approach to determining physical changes based on a set of assumptions and datasets.

- **Model** – a standardized and accepted quantitative method, based on procedures, computer algorithms/codes and standard input datasets; often linked to other models and may require user interaction; may be tailored for application to a specific project analysis.
- **Projected condition** – a set of estimates of modified climate, meteorology, hydrology, land and water use, water quality, ecosystem attributes or other inputs for analysis of the water resources system (e.g., in the future).
- **Long-term planning analysis** – description of the water resources system over a long period of record (historical sequence) modified by a projected condition inputs considering potential changes to facilities, standards and operations.
- **Level of development** – description of water demands based on population, land and water use patterns, water rights and contracts at a point in time.

4 General Common Assumptions and Recommendations

This section presents Common Assumptions and recommendations for with and without project conditions, methods and metrics for analysis of physical changes in general. Section 5 presents more specific recommendations by resource areas.

4.1 With and Without Project Conditions

This section presents Common Assumptions and recommendations for describing the with and without project conditions and analyzing the physical changes created or caused by the proposed project. Included are discussions of the requirements of applicants regarding CEQA, understanding of the water resources system, project related additions and modifications, geographic scope and sources of uncertainty. Section 5 presents more specific recommendations by resource areas.

4.1.1 CEQA Considerations

The Act requires that environmental documentation associated with the project be completed prior to allocation of funds (§79755(a)(5)(C)). A project applicant is required to submit a publicly available draft CEQA document as part of application to the Commission.

The without project condition for the WSIP is analogous to the No Project Alternative used for CEQA. However, it is unlikely that the No Project Alternative will be consistently defined and evaluated across all applicants given the study area and scope of analysis required by CEQA for each proposed project and the potential variety of project types, locations and potential benefits considered across all proposed projects. Therefore, any requirements for the without project condition should provide flexibility to the applicants.

CEQA Guidelines (§15126.2(a)) indicate that an Environmental Impact Report (EIR) shall identify and focus on the significant environmental effects of the proposed project. Direct and indirect significant effects of the project on the environment shall be clearly identified and described, giving due consideration to both the short term and long term effects. CEQA requires an analysis of the No Project Alternative in which the proposed project is not implemented. The No Project Alternative allows

decision-makers to use the EIR to compare future conditions impacts with or without approving the proposed project. Under CEQA, the No Project Alternative is the baseline for assessing the significance of impacts of the proposed project (CEQA Guidelines §15126.6(c)(1)).

Selection of the No Project Alternative for a CEQA analysis varies by the definition of Existing Conditions and the criteria used to determine changes from the Existing Conditions. CEQA Guidelines (§15125(a)) indicate than an EIR must include a description of the physical environmental conditions in the vicinity of the project as they exist at the time the Notice of Preparation (NOP) is published, or if no NOP is published, at the time environmental analysis is commenced, from both a local and regional perspective. This date is referred to in this document as the demarcation date for the Existing Conditions. A CEQA lead agency can choose to revise the demarcation date to a date later than the NOP. CEQA Guidelines (§15126.6(e)(2)) indicate that the No Project Alternative include reasonably foreseeable changes in the Existing Conditions and changes that would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services.

A similar logic could be used by applicants for selection of the without project condition for WSIP applications. This would include a demarcation date for existing conditions and a set of criteria for determining changes between the without project condition and the demarcation date.

It is unlikely that CEQA NOP dates and the set of criteria for determining changes used for CEQA will be consistent across all applications. For selecting the without project condition for a proposed project under consideration for WSIP funding, the demarcation date should be set to the latest possible date.

Requirements:

- Applicants are required to define and discuss the implications of differences between the CEQA NOP date and the demarcation date for the WSIP application.
- Applicants are required to disclose differences between their CEQA No Project Alternative and the WSIP without project condition provided for the WSIP application.
- Applicants are required to provide quantitative sensitivity analyses if the CEQA and WSIP differences are potentially material to the analysis of physical changes.

4.1.2 Understanding the Operations of the Water Resources System

Planning analyses of water resources systems vary widely depending on objectives. For the WSIP, a long-term planning analysis method based on facilities, level of development, standards and operations is appropriate (refer to section 4.2.1 Long-term Planning Analysis and Projected Condition for more discussion on this).

Facilities, level of development, standards and operations refer to how an analysis characterizes:

- Facilities (e.g., hydrographic features);

- Level of development - Water demands (i.e., population, land and water use), water rights and contracts at a point in time;
- Standards, regulations, decisions, and permits, (i.e., limits, thresholds and priorities); and
- Facilities operations criteria, operations agreements and other policies (i.e., rules).

The facilities, level of development, standards and operations to be included in the analysis are based on the criteria defined in section 4.1.1. CEQA Considerations.

It is expected that applicants have substantial knowledge of the facilities in the watersheds influenced by the proposed project, including: water demands, water rights and contracts, standards, regulations, decisions, permits, and agreements. In addition, a detailed understanding is required of the criteria that govern diversion, storage, flow and management of water for the local watershed and region. It should be required that the applicant incorporate applicable information that is publicly available for the local watershed/region in their without project conditions and analyses.

The SWP has facilities in the Feather River watershed and the Delta. The CVP has facilities in the Trinity, Sacramento, American, Stanislaus, and San Joaquin River watersheds and the Delta. SWP and CVP facilities operate under the requirements of State Water Board Water Right Decision 1641 (SWRCB, 1999), the December 2008 U. S. Fish and Wildlife Service (USFWS) Biological Opinion (USFWS, 2008) and the June 2009 National Marine Fisheries Service (NMFS) Biological Opinion (NMFS, 2009), among other standards, regulations, decisions, permits, agreements and policies. The SWP and CVP Trinity, Sacramento, Feather and American River and Delta facilities operations are coordinated under the 1986 Coordinated Operating Agreement (COA) (U.S. Bureau of Reclamation and DWR, 1986).

If applicable to the analysis of proposed project, operations related to the Delta, Biological Opinions and the SWP and CVP, summarized in **Tables 2 and 3**, should be incorporated in the analyses provided by applicants.

In **Table 2**, operations related to the reasonable and prudent alternative (RPA) actions, are written with sufficient detail in the December 2008 USFWS Biological Opinion and June 2009 NMFS Biological Opinion, to include in the applicant's analysis. Inclusion of these RPA actions in the without project condition should not imply that the objectives of the RPA are met under all hydrologic and operational conditions. The water resources system is operated to achieve the objectives of the RPA to the extent possible with the facilities and operational policies in place in 2015, subject to forecasted information and discretion of SWP and CVP operators in consultation with the regulatory agencies and stakeholders.

Table 2. Operations Related to the Delta and Biological Opinions.

State Water Board Water Right Decision 1641 (SWRCB, 1999)
San Joaquin River At Vernalis – Minimum flow
San Joaquin River At Vernalis – Maximum salinity
Lower Sacramento River At Rio Vista – Minimum flow
Delta Outflow Index – Minimum flow
Delta Outflow Index – Maximum salinity – Emmaton, Jersey Point, Rock Slough, Collinsville and Chipps Island
Delta Outflow Index – Spring X2 Position
Delta Cross Channel – Gate operation
South Delta Intakes – Maximum Delta exports
Trinity River Mainstream Fishery Restoration Record of Decision (U.S. Department of the Interior, 2000)
Below Lewiston Dam – Minimum flow – Trinity EIS Preferred Alternative (369-815 TAF/year)
December 2008 USFWS Biological Opinion (USFWS, 2008)
Combined Flow in Old and Middle River – Minimum flow – Actions 1 through 3
Delta Outflow Index – Fall X2 Position – Action 4
Head of Old River – Barrier Operation – Action 5
June 2009 NMFS Biological Opinion (NMFS, 2009)
Sacramento River Below Whiskeytown Dam – Minimum flow – Action I.1.1
Red Bluff Diversion Dam – Operated with gates out all year based on Action I.3.1
Shasta Lake – Minimum end-of-September storage – Action I.2.1
Sacramento River Below Keswick Dam – Minimum flow – Action I.2.2
Sacramento River At Wilkins Slough – Flow objective for navigation – Action I.4
American River Below Nimbus Dam – Minimum flow – American River Flow Management proposal as required by Action II.1
Stanislaus River Below Goodwin Dam – Minimum flow – Action III.1.2 and III.1.3
Delta Cross Channel – Gate operation – additional days closed from Oct 1 – Jan 31 based on Action IV.1.2
South Delta Intakes – Maximum Delta exports – Action IV.2.1 Apr 1 – May 31
Combined Flow in Old and Middle River – Minimum flow – Action IV.2.3

Table 3. Operations Related to the SWP and CVP.

SWP Water Allocation Criteria	Settlement (Feather River Service Area) – Contract specific
	Agricultural (Ag) and Municipal & Industrial (M&I) Service – Based on supply; equal prioritization between Ag and M&I based on Monterey Agreement; South-of-Delta allocations are additionally limited due to State Water Board Water Right Decision 1641 and USFWS Biological Opinion (Dec 2008) and NMFS Biological Opinion (Jun 2009) export restrictions; includes Monterey Agreement turn-back provisions and Article 56 contractor carryover
	Monterey Agreement Article 21 – Based on Delta excess flows, export and conveyance capacity available to contractor when San Luis Reservoir is full
CVP Water Allocation Criteria	Settlement / Exchange – 100% (75%/77% in Shasta critical years)
	National Wildlife Refuges Firm Level 2 – 100% (75% in Shasta critical years)
	M&I Service – Tiered (4 tiers) allocation rule, 100%-50% based on supply, South-of-Delta allocations are additionally limited due to State Water Board Water Right Decision 1641, USFWS Biological Opinion (Dec 2008) and NMFS Biological Opinion (Jun 2009) export restrictions
	Ag Service – Tiered (4 tiers) allocation rule, 100%-0% based on supply, South-of-Delta allocations are additionally limited due to State Water Board Water Right Decision 1641, USFWS Biological Opinion (Dec 2008) and NMFS Biological Opinion (Jun 2009) export restrictions
SWP-CVP Coordinated Operations	Sharing of responsibility for in-basin-use – 1986 Coordinated Operations Agreement (Freeport Regional Water Project East Bay Municipal Utility District and 2/3 of the North Bay Aqueduct diversions considered as Delta Export; 1/3 of the North Bay Aqueduct diversion as in-basin-use)
	Sharing of surplus flows – 1986 Coordinated Operations Agreement
SWP-CVP Sharing of Allowable Export Capacity	Sharing of export capacity for project-specific priority pumping – Equal sharing of export capacity under State Water Board Water Right Decision 1641, USFWS Biological Opinion (Dec 2008) and NMFS Biological Opinion (Jun 2009) export restrictions
	Sharing of export capacity for lesser priority and wheeling-related pumping – Cross Valley Canal wheeling (max of 128 TAF/year), CALFED ROD defined Joint Point of Diversion
Use of Export Capacity for Conveyance of Water transfers	Monterey Agreement Article 55 – SWP contractors priority use of Banks Pumping Plant capacity for water transfers
	Lower Yuba River Accord – Acquisitions of Component I are used to reduce impact of NMFS Biological Opinion export restrictions on SWP; acquisitions for SWP contractors are wheeled at priority in Banks Pumping Plant over non-SWP users

Requirements:

- Applicants are required to provide information that is publicly available for the without project conditions and include, in their analyses, facilities, water demands, water rights and contracts, standards, regulations, decisions, permits, agreements and criteria that govern the diversion, storage, flow and management of water for their proposed project.
- Applicants are required to include, if applicable to the analysis of a proposed project, all required operations related to the Delta, Biological Opinions and the CVP and SWP as summarized in **Tables 2 and 3**. If the applicants determine that the required operations are not applicable to the analysis of a proposed project, they are required to explain why.

4.1.3 Project Related Additions and Modifications

The with project condition is based on the without project conditions and includes any and all additions or modifications specific to the applicant's proposed project. The with project condition is a quantitative and qualitative description of the water resources system with the proposed project. The expected physical changes created or caused by the proposed project will be calculated by comparing the results of the with and without project condition; therefore it is important that changes in the description of the with project condition should be limited to only additions and modifications that are based on the applicant's proposed project description and operations plan.

The description of the with project condition must be sufficient to support the analysis of the expected physical changes related to the project description, operations plan and all potential benefits of the proposed project including all resource areas shown in **Figure 1**.

Requirements:

- Applicants are required to provide quantitative and qualitative with and without project conditions for use as the basis of identifying and calculating the expected physical changes caused or created by the proposed project. Any differences between with and without project conditions not specified as an addition or modification associated with the proposed project must be disclosed.
- Applicants are required to document with and without project conditions, how calculations of expected physical changes are derived, and show the linkage between a proposed project, its operations plan, and the expected physical changes caused or created by the proposed project.

4.1.4 Geographic Scope

Physical changes, caused or created by a proposed project, may extend beyond the local watershed depending on the magnitude and timing of diversions, storage, flows and management of water. Physical changes may propagate throughout the water resources system through interaction with facilities, water uses and requirements associated with other water users, districts and projects.

Potential interactions may require an applicant to expand the study area for analysis to include:

- The watershed/region in which the proposed project is located in or connected to, (including reaches/areas upstream);
- Neighboring watersheds/regions where changes could occur at existing or proposed interconnections;
- Downstream watersheds/regions where changes could occur; and
- Watersheds/regions that are tributary to the watershed/region, neighboring, or downstream watersheds/regions, where changes could.

Potential changes in SWP and CVP operations including Trinity, Sacramento, Feather and American River and Delta facilities operations may require an applicant to expand the study area for analysis to include these watersheds.

Requirements:

- Applicants are required to include, in their study area for analysis, any watershed(s)/regions(s), including SWP and CVP watersheds, which may have physical changes caused or created by their proposed project.

4.1.5 Sources of Uncertainty

Analysis of the potential variation of physical changes caused or created by a proposed project may be subject to various sources of uncertainty as represented in **Figure 1.** Uncertainties, such as climate change and sea level rise, are factors that could affect a project's feasibility, durability, resiliency and duration of benefits. It is important to address potential sources of uncertainty to inform the evaluation of the proposed project. Sensitivity analysis is an effective method to evaluate potential sources of uncertainty that are not already considered in the analysis of expected physical changes. This analysis can include quantitative and qualitative assessments.

Assumptions are provided to the applicant for quantitative sensitivity analysis of potential uncertainties related to climate change and sea level rise not considered in the without project condition. [Attachment A-1 in development].

Assumptions are provided to the applicant for quantitative sensitivity analysis of a range of potential uncertainties related to Delta outflow requirements not considered in the without project condition. [Attachment A-2 in development].

Assumptions are provided to the applicant for qualitative sensitivity analysis of a range of potential uncertainties related to other water management actions not considered in the without project condition. [Attachment A-3 in development]. Other potential future changes identified in the cumulative analyses for environmental documents for the proposed project should also be considered.

Requirements:

- Applicants are required to provide a quantitative sensitivity analysis to identify how the expected physical changes caused or created by the proposed project would be changed by potential climate change and sea level rise.
- Applicants are required to provide a quantitative sensitivity analysis to identify how the expected physical changes caused or created by the proposed project could be changed by a potential range of Delta outflow requirements.
- Applicants are required to provide a qualitative sensitivity analysis to identify how the expected physical changes caused or created by the proposed project could be changed by a range of other water management actions and those included in the CEQA cumulative conditions from the proposed project environmental documents.

4.2 Methods and Models

This section presents general Common Assumptions and recommendations for analytical methods and models used for developing with and without project physical conditions, and calculating physical changes created or caused by the proposed project. Section 5 presents more specific recommendations by resource areas.

4.2.1 Long-term Planning Analysis and Projected Condition

Methods for analysis of water resources systems can vary widely. For the WSIP, a long-term planning analysis method based on the following is appropriate:

- Descriptive simulations using methods and models (i.e. “what if?” query);
- Using a long period of record (e.g. 75 – 100 years) and monthly time step;
- Use of meteorology and projected hydrology varying in historical sequence with drought sequences preserved; and
- Assuming a fixed set of conditions about facilities, level of development, standards and operations for the entire simulation.

Projected conditions refers to the set of estimates of modified climate, meteorology, hydrology, land and water use, water quality, ecosystem attributes or other inputs for analysis of the water resources system. It can also refer to the results of a long-term planning descriptive analysis of the system using these inputs. The methods, models, and datasets implicitly capture variability associated with hydrological, meteorological and water quality information and dependent standards, agreements and operations. The results can be sorted and summarized in various ways to understand the outcomes and probabilities associated with specific conditions in the context of the projected conditions inputs used.

Historical datasets of precipitation, land use, river flows, diversions, reservoir storages, and groundwater levels provide information to understand the system and its behavior in the past. However, unmodified historical hydrologic data has limited usefulness in analyzing the potential behavior of a water resources system because it does not account for the changes in water development, land use, impairments and

other changes across the historical condition and into the future. Hydrologists, through a series of calculations and understanding of the system, can estimate projected values for many of the physical variables involved. This includes water accretions and depletions along segments of the river, tributary flows and other hydrologic variables and terms important for the analysis. The projection and synthesis of hydrologic information in turn allows for the projection and synthesis of other information for specific resource areas, such as water quality and aquatic biological resources.

The Long-term Planning Analysis using Projected Conditions presented above is an effective and efficient technique to calculate the expected physical changes created or caused by a proposed project. The applicant should consider the following:

- **Descriptive and prescriptive analyses**
    - Descriptive analyses simulate the expected outcome of a proposed project and are used to determine the magnitude and frequency of expected physical changes.
    - Prescriptive analyses are used to determine what can be altered to achieve a desired outcome; prescriptive analyses may be important for formulation of a project to meet objectives and could be part of the work an applicant has done in developing their proposal.
- **Projected hydrology and historical records**
    - Projected hydrology calculations account for modifications in hydrologic conditions due to changes in population, water development, land use, impairments and other changes.
    - Historical records do not reflect these projected modifications but provide observations about the varying conditions that occurred at the time of collection and are the basis for understanding the water resources system.
- **Available period of record** – Analyses should use the available period of record for meteorological, surface water and groundwater hydrology, water quality and other data. A period of record selected for an analysis should reflect the range and probability of values observed in the longest records.
- **Methods, period of record and time-step to match analysis objectives**
    - For proposed water storage projects, descriptive analyses using monthly time-steps over long periods can capture changes in storage through long periods of time to account for storage carryover, multiple year recharge/overdraft, etc. Analyzing selected averages based on selected water year-types (e.g. wet, normal dry) or short sequences of years would not reflect changes in storage conditions that may affect project operations.
    - For evaluating flood events, design-event based analyses using daily time-steps over weeks to months can captures the hydrology, hydraulics and operational rules of flood management. Analyzing expectations of flood control benefits requires analysis of flood event probabilities over the long period of record.
    - For evaluating ecological conditions, results from both descriptive analyses over long periods and design-event based analyses using short time-steps and periods can integrated together to evaluate targeted periods of floodplain inundation for specific wildlife (e.g. juvenile salmonid rearing involves thresholds for multiple days of duration every two years).

- **Analysis scope** – The scope of an analysis has to be defined narrowly to make best use of the data available, but broad enough to capture any interactions that are important to the objectives of the analysis. The water resources system is complex and interconnected and the availability of data is limited in period of record, location and type. The analysis scope should be tested to make sure that terms that are assumed to be static in value (i.e. boundary condition terms) are themselves independent of the solution. Limitations of the analysis related to scope should be included in documentation.

Requirements:

- Applicants are required to provide descriptive analyses using: a long period of record (i.e., an appropriate range to capture hydrologic variability, including distribution of water year types, driest and wettest years, and extended drought conditions); a monthly time step; meteorology and projected hydrology varying in historical sequence; and assuming a fixed set of assumptions about facilities, level of development, standards and operations.
- Applicants are required to use period(s) of hydrologic record data to account for the range of variability and distribution of values observed in the longest records.
- Applicants are required to include long-term sequential use of methods, models, and datasets in their analyses; individual years or short sequences of years should only be used for appropriate objective analyses such as flood control or ecological benefits.

Recommendations:

- Applicants should use a projected hydrology in their analyses or employ an equivalent analysis that reflects hydrologic changes due to changes in population, land and water use from the historical period of record to time period of interest. Hydrology of potential climate change should be addressed through sensitivity analyses discussed in Section 4.1.5 Sources of Uncertainties.
- Applicants should define a broad scope of analyses to capture any interactions that are important to the objectives of the analysis such as storage effects; limitations of the analysis related to scope should be included in documentation.

4.2.2 Methods for Quantitative Sensitivity Analysis

Uncertainties that are not implicitly evaluated as part of determining expected physical changes can be evaluated through sensitivity analyses. Sensitivity analysis can include quantitative and qualitative assessments of the potential effect of uncertainties. Sensitivity analysis may be limited to physical changes of diversion, storage and flow if the results demonstrate that the effects of the potential uncertainties are not material to the evaluation of the proposed project.

Requirements:

- For quantitative sensitivity analysis, applicants are required to use the same methods and datasets as in the analysis of expected physical changes, modified for the potential change for which the

sensitivity analysis is being performed. Both with and without project conditions are to be modified for the potential change. Each potential change for which the sensitivity analysis is being performed should be evaluated independent of other changes.

4.2.3 Integration of Methods of Analysis

The evaluation of expected physical changes created or caused by a potential project can be diverse in location and time. Assessing potential benefits to ecosystem, water supply, water quality, flood control, emergency response, hydropower, and recreation depends on diverse methods with varying periods of record and time-steps. The following are questions to be addressed in quantifying expected physical changes in range and probability of values.

- How are design-event based methods (e.g., flood event) integrated and reconciled with long term planning analysis methods?
- How are short time-step analysis methods (e.g., diurnal or daily) integrated and reconciled with long term planning analysis methods?

Requirements:

[In development]

4.2.4 Disclosure and Access

The Commission requires full disclosure and access to the datasets, models and other tools used by the applicant to calculate physical changes created or caused by the proposed project. This is necessary for the proposal evaluators to efficiently and thoroughly review and compare project applications.

Requirements:

- Applicants are required to identify all methods used and provide documentation, procedures, computer codes, input datasets and outputs for each method used. Documentation must include the details on development, calibration and verification of the method or model, its use in the analysis and development of the analysis including sources of datasets and interpretation of outputs. Any proprietary information or licenses required to run models must be provided by the applicant.

4.2.5 Comparability of with Project Condition

“Comparability” means that the analysis of the with project condition has only the proposed project changes in facilities and/or operations added to the without project condition. Any other water management action not included in the project description of the proposed project must be addressed through sensitivity analyses as described in Section 4.1.5 Sources of Uncertainty.

Requirements:

- Applicants are required to produce analyses specific to the facilities and operations of the proposed project in the with project conditions. Any changes in the methods, inputs and outputs between with project and without project conditions must correspond to specific elements of the proposed project description and operations plan included in the application.

4.3 Metrics

Metrics are quantitative or qualitative measures of physical change between with project and without project conditions. This section presents Common Assumptions and recommendations for the metrics to be used in the analysis and evaluation of all proposed projects. Section 5 presents more specific recommendations by resource areas.

4.3.1 Parameters, Reporting Units and Locations

Methods and models are used for with project and without project conditions so that metrics of physical changes can be determined. The Commission requires thorough documentation of modeling methods and results in order to verify project operations and benefits. Results should be provided in raw form for each year and time-step as determined by the method used. Results should be provided in processed or summary format according to the guidance in this document.

To support comparison of projects one to another, a standard list of parameter definitions, reporting units and locations is provided to the applicants. Applicants must provide analysis results so that metrics of physical changes can be determined for the standard set of parameter definitions, reporting units and locations. [Attachment A-4 in development]. Applicants must provide results for parameters and locations that are important for describing the metrics of physical changes unique to their proposed project.

Requirements:

- Applicants are required to provide all applicable results of methods and models for with project and without project conditions so that metrics of physical changes can be determined for the standard set of parameter definitions, reporting units and locations.
- Applicants are required to provide results, including time series data (model results, spreadsheets, calculations, etc.) for parameters and locations that are important for describing the metrics of physical changes unique to their proposed project according to the proposed project description and operations, monitoring and assurance plans submitted with the application.

4.3.2 Summary Statistics

To support the evaluation criteria used for selection and evaluation of proposed project, a standard set of summary statistics should be defined. These statistics should recognize the limitations of the

methods and datasets used but allow for understanding of the expected changes created or caused by a proposed project in comparison with others.

In presenting summary statistics of physical changes created or caused by a proposed project, the applicant should consider the following:

- Time-step consistency with methods used
- Location consistency with methods used
- Consideration of interactions within and between methods and models used
- Reporting of full period of record, selected period, or year-type class based averages of results (avoiding selective use of single, and minimum or maximum values)
- Reporting of probability distributions of results (avoiding partial or range limited values)

Requirements:

[In development]

4.3.3 Full Accounting and Disclosure of Results

A summary report showing the complete accounting of physical changes in the diversion, storage, flow and management of water created or caused by the proposed project over the long-term and a selected drought period is an effective and efficient way of presenting the physical changes created or caused by a proposed project.

[Sample templates in development]

Requirements:

- Applicants are required to provide a summary report showing the complete accounting of physical changes in the diversion, storage, flow and management of water created or caused by the proposed project over the long-term and a selected drought period (standard period or other).
- [In development with evaluation criteria]

Recommendations:

- Applicants should provide summary reports for each type of potential beneficiary by applicable metric, location, season or other period of time.
- Applicants should provide necessary information to show how the physical changes created or caused by the proposed project link to each targeted benefit included in the project description and operations plan (e.g., linked presentation of metrics showing storage -> flow release -> habitat improvement -> fisheries benefit).
- [In development with evaluation criteria]

5 Resource Areas [In development]

5.1 Surface Water Operations
5.2 Groundwater Operations
5.3 Riverine Conditions
5.4 Delta Conditions
5.5 Surface Water Quality
5.6 Groundwater Quality
5.7 Aquatic Biological Resources
5.8 Terrestrial Biological Resources
5.9 Energy Resources
5.10 Recreation Resources
5.11 Other Resources

6 Economics

The economic common assumptions are discussed in a companion document *Working Paper for WSIP Common Assumptions – Economics*.

7 References

CEQA Guidelines. [TBD]

Monterey Agreement. [TBD]

CALFED Bay-Delta Program (CALFED). 2000. CALFED Programmatic Record of Decision. July.

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National Marine Fisheries Service (NMFS). 2009. Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project. June 4. Southwest Region. Long Beach, CA.

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U.S. Fish and Wildlife Service. 2008. Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP). December 15. Region 8. Sacramento, CA.

Attachments for Proposed WSIP
Common Assumptions and Recommendations – Physical Changes

DRAFT

July 30, 2015

A-1 Potential Uncertainty in Climate and Sea Level Conditions

The following is a description of potential climate change and sea level rise that are not included in the without project condition. These assumptions are for quantitative sensitivity analysis to evaluate how potential uncertainty in climate change and sea level rise may affect the expected physical changes created or caused by a potential project.

One significant limitation of the long-term planning analysis and projected condition methods described in Section 4.2.1 is the assumption of "stationarity." Stationarity refers to a time-series dataset whose parameters such as mean and variance do not change over time and do not follow any trends. Climate, meteorological and hydrological datasets have weak stationarity; the mean and variance change over time. The following climate change and sea level rise inputs are developed for use in sensitivity analyses to address current understanding of climate trends and inform the analyses of proposed projects to address this limitation.

[Information being developed]

A-2 Potential Uncertainty in Delta Water Quality Control Plan Requirements

The following is a description of the potential range of Delta outflow requirements that are not included in the without project condition. These assumptions are for quantitative sensitivity analysis to evaluate how potential uncertainty in Delta outflow requirements may affect the expected physical changes created or caused by a potential project.

[Information being developed]

A-3 Potential Uncertainty in Other Water Management Actions

The following is a list of potential future projects and other water management actions that are not included in the without project conditions. These potential actions may affect the future condition in structural, operational and regulatory ways.

[Information being developed; list shown is draft and subject to revision]

- CALFED surface storage related
  - In-Delta Storage Program (Delta Wetlands)
  - Los Vaqueros Reservoir Expansion Phase III
  - North-of-Delta Offstream Storage Investigation
  - Shasta Lake Water Resources Investigation
  - Upper San Joaquin River Basin Storage Investigation (Temperance Flat)
- Other storage related
  - FERC Relicensing Projects
  - San Luis Reservoir Expansion
  - San Luis Reservoir Low-Point Improvement Project
  - Sisk Dam Corrective Action Project
- Sacramento River Basin related
  - Central Valley Flood Protection Plan – Sacramento BWFS
  - Yolo Bypass – Salmonid Habitat Restoration and Fish Passage Project, NMFS BO Action I.7
  - Sustainable Groundwater Management (SGM) Program implementing the 2014 Sustainable Groundwater Management Act (SGMA)
- San Joaquin River Basin related
  - Central Valley Flood Protection Plan – San Joaquin BWFS
  - Friant-Kern Canal and Madera Canal Capacity Restoration Projects
  - Friant-Kern Canal Reverse Flow Project
  - Lower San Joaquin River and Delta South Regional Flood Management Project
  - San Joaquin River Restoration Program – Full Restoration Flows
  - San Luis Drainage Reevaluation Program
  - SGM Program implementing the 2014 SGMA
- Delta related
  - Bay Delta Conservation Plan (California WaterFix and California EcoRestore)
  - Cache Slough Restoration
  - Delta-Mendota Canal Recirculation Project
  - Franks Tract Project
  - North Bay Aqueduct Alternative Intake
  - North Delta Flood Control and Ecosystem Restoration Project (McCormack-Williamson)
  - Potential Changes to the State Water Board Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary

A-4 Standard List of Parameters, Reporting Units, and Locations

The following is a standard list of parameter definitions, reporting units and locations for use in the reporting of physical changes.

[Information being developed]