



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SOUTH ATLANTIC DIVISION
60 FORSYTH STREET SW, ROOM 10M15
ATLANTA, GEORGIA 30303-8801

CESAD-RBT

22 May 2019

MEMORANDUM FOR COMMANDER, JACKSONVILLE DISTRICT

SUBJECT: Approval of the Review Plan for the Rio de la Plata Flood Control Project Hydrology and Hydraulic (H&H) Products

1. References:

a. Memorandum, CESAJ-EN-Q, 9 May 2019, subject as above.

b. Engineering Circular (EC) 1165-2-217, Water Resources Policies and Authorities Review Policy for Civil Works, 20 February 2018.

2. The Review Plan (RP) for the H&H product documents for the Rio de la Plata Flood Control Project and reference 1.a noted above have been reviewed by South Atlantic Division (SAD). This RP was coordinated with and endorsed by the Risk Management Center (RMC). SAD concurs with the conclusion that a Type II Independent External Peer Review (IEPR) of the subject project is not required. The RP is hereby approved in accordance with reference 1.b.

3. SAD concurs with the District's RP recommendation that outlines the requirements for District Quality Control (DQC) and Agency Technical Review (ATR) and that a Safety Assurance Review/Type II Independent External Peer Review is not required. Documents to be reviewed include products and associated data resulting from the HEC-HMS hydrologic routing and the HEC-RAS hydraulic routing models.

4. The USACE RMC shall be the Review Management Organization for this project.

5. The District should take steps to post the approved RP to its website and provide a link to CESAD-RBT. Before posting to the website, the names of Corps/Army employees should be removed. Subsequent significant changes to this RP, such as scope or level of review changes, should they become necessary, will require new written approval from this office.

6. The SAD point of contact is [REDACTED].

[REDACTED]
Director of Programs



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8915

09 MAY 2019

CESAJ-EN-Q

MEMORANDUM FOR Commander, South Atlantic Division (CESAD-RBT), 60 Forsyth Street SW, Room 10M15, Atlanta, GA 30303

SUBJECT: Approval of Review Plan for the Rio de la Plata Flood Control Project Hydrology and Hydraulic Products

1. References.

- a. Engineering Circular (EC) 1165-2-217, Review Policy for Civil Works, 20 Feb 18.
- b. Water Resources Development Act of 1990, Public Law 101-640, 12 Nov 90.

2. I hereby request approval of the enclosed Review Plan for the Rio de la Plata Flood Control Project Hydrology and Hydraulic Products and concurrence with the conclusion that a Type II Independent External Peer Review (IEPR) of the subject project is not required. The recommendation not to perform a Type II IEPR is based on the EC 1165-2-217 Risk Informed Decision Process as presented in the Review Plan. The Review Plan complies with applicable policy, provides for Agency Technical Review, and has been coordinated with the CESAD. It is my understanding that non-substantive changes to this Review Plan, should they become necessary, are authorized by CESAD.

3. The district will post the CESAD approved Review Plan to its website and provide a link to the CESAD for its use. Names of Corps/Army employees will be withheld from the posted version, in accordance with guidance.

4. If you have any questions regarding the information in this memo, please feel free to contact me or contact [REDACTED].

Encl

[REDACTED]
COL, EN
Commanding



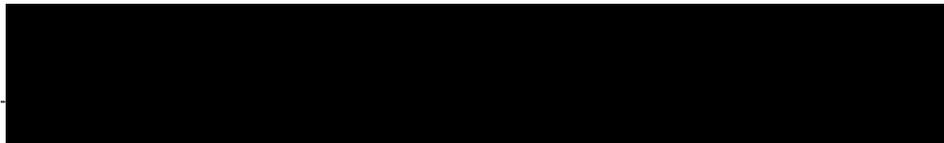
US Army Corps
of Engineers.

Prepared by:
SAJ District
SAD Division

Rio de la Plata Flood Control Project Hydrology and Hydraulic Products

Review Plan

PREPARED
BY:



Chief, Hydraulic Design Section
USACE, Jacksonville District

ENDORSED
BY:



Chief, Eastern Division
USACE, Risk Management Center

MSC Approval Date:

Last Revision Date: *None*

This information is distributed solely for the purpose of pre-dissemination review under applicable information quality guidelines. It has not been formally disseminated by USACE. It does not represent and should not be construed to represent any agency determination or policy.

Section 1

Introduction

1.1 Purpose

This Review Plan (RP) for the Hydrology and Hydraulic (H&H) products of the Rio de la Plata Flood Control Project (P2# 114175) will help ensure a quality-engineering project is developed by the Corps of Engineers in accordance with EC 1165-2-217, "Review Policy for Civil Works." As part of the Project Management Plan, this RP establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products and describes the scope of review for the current phase of work. This RP is solely focused on the hydrologic and hydraulic products of the Rio de la Plata Flood Control Project. Products include the HEC-HMS hydrologic routing model and supporting documentation (prepared under AE contract) and the HEC-RAS hydraulic routing model and supporting documentation. The results of this review will be provided in subsequent project reviews of the design phase implementation documents, including the plans and specifications (P&S) and the Design Documentation Report (DDR), as a reference. The H&H products will not require further review unless significant changes are made to them during the design phase that cause previous reviews to be superseded. A separate review plan will be developed describing the scope of review for the design phase implementation documents associated with the remaining construction contracts of the Rio de la Plata Flood Control Project.

1.2 References

- EC 1165-2-217, Review Policy For Civil Works, 20 February 2018
- ER 1110-1-12, Quality Management, 31 March 2011
- ER 415-1-11, Biddability, Constructability, Operability, Environmental and Sustainability (BCOES) Reviews, 1 January, 2013
- EM 1110-2-1913 Design, Construction, and Evaluation of Levees, 30 April 2000
- Draft ECB: Interim Approach for Risk-Informed Designs for Dam and Levee Projects
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- EM 1110-2-1418, Channel Stability Assessment for Flood Control Projects, 31 October 1994
- EM 1110-2-1601, Hydraulic Design of Flood Control Channels, 1 July 1991
- EM 1110-2-1913, Design and Construction of Levees, 30 April 2000
- EM 1110-2-2502, Retaining and Flood Walls, 29 September 1989
- EM 1110-2-2504, Design of Sheet Pile Walls, 31 March 1994
- EM 1110-2-2902, Conduits, Culverts, and Pipes, 31 March 1998
- ETL 1110-2-583, Engineering and Design: Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures

- U.S. Department of Interior Bureau of Reclamation and US Army Corps of Engineers, Best Practices in Dam and Levee Safety Risk Analysis, 1 July 2015 (or most recent version)
- U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC), Hydrologic Modeling System HEC-HMS User's Manual, CPD-74A, Hydrologic Engineering Center, Davis, CA.
- U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC), HEC-RAS River Analysis System User's Manual, CPD-68, Hydrologic Engineering Center, Davis, CA.
- U.S. Army Corps of Engineers (USACE), Jacksonville District (July 2018). *Validation Report – Continuing Construction Validation Report for Supplemental Appropriations Bill*, Jacksonville, FL.
- U.S. Army Corps of Engineers (USACE), Jacksonville District (January 2017). *Design Documentation Report (DDR) - Dorado Bridge Channel Widening & Scour Protection, Section 4 – Hydraulic Design*, Jacksonville, FL.
- Taylor Engineering, Inc. (January 2017). *Rio de la Plata Flood Control Project Contracts 1B, 2, and 3 Final Report*, Jacksonville, FL.
- U.S. Army Corps of Engineers (USACE), Jacksonville District (July 2016). *Limited Reevaluation Report (LRR) Hydrologic and Hydraulic Modeling Appendix*, Jacksonville, FL.
- Taylor Engineering, Inc. (January 2016). *Rio de la Plata Flood Control Project Contracts 1B, 2, and 3 Final Report*, Jacksonville, FL.
- CMA Architects & Engineers LLP (March 2011). *DDR - Rio de la Plata, Phase I Flood Damage Reduction Contract 1A Design*, San Juan, Puerto Rico.
- HNTB Corporation (February 2010). *Rio de la Plata Flood Control Project 2D Model Analyses, Contract 1A Interim Conditions*, Kansas City, MO.
- U.S. Army Corps of Engineers (USACE), Jacksonville District (May 1993). *Rio de la Plata, Puerto Rico General Design Memorandum*, Jacksonville, FL.
- U.S. Army Corps of Engineers (USACE), Jacksonville District (April 1992). *Rio de la Plata, Puerto Rico Limited Reevaluation Report*, Jacksonville, FL.
- Project Management Plan (PMP) for Rio de la Plata Flood Control Project (P2#114175)

1.3 Review Management Organization

The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for this product. Contents of this RP have been coordinated with the RMC and South Atlantic Division (SAD), the Major Subordinate Command (MSC).

Section 2

Project Description

2.1 Project Description

The Rio de la Plata project was authorized for construction by the Bipartisan Budget Act of 2018 (Public Law 115-123), enacted 9 February 2018, and provided funding in support of recovery efforts following Hurricanes Harvey, Irma, and Maria. The Rio de la Plata basin is located in the north central part of Puerto Rico. It drains about 240 square miles (mi²) of land from the mountainous central ridge of Puerto Rico and falls about 2,960 feet in elevation in a distance of about 63 miles northward to the Atlantic Ocean near the town of Dorado, located about 11 miles west of San Juan.

The project addresses flood damages caused by the 100-yr and SPF rainfall runoff events. Channel improvements provide a 100-year level of protection in areas not protected by project levees. Project levees provide an SPF (1,000 year) level of protection. The plan of improvement contains approximately 7.3 miles of channel improvement, 6.3 miles of levees; 3.0 miles for the west levee and 3.3 miles for the east levee, 8 culvert structures in the levees, replacement of the PR-2 Bridge and a grade control structure.

The Rio de la Plata Flood Control Project is a single-purpose project designed to provide Standard Project Flood (SPF), 1,000-year, level of protection for flooding from the Rio de la Plata for all developments in the river basin downstream of Highway 2, except at El Polvorin and 100-year flood protection for the areas upstream of Highway 2 up to the Toa Alta/San Jose area and El Polvorin Area.

Flooding is a problem in the project area threatening life, property, public buildings, roads, and commercial facilities. Heavy rainfall, combined with very steep slopes, produces high discharges in a relatively short period of time in the project area. The entire town of Toa Baja and portions of the towns of Dorado, Toa Alta, and Levittown, as well as, the communities of Mameyal, Toa Ville, Ingenio, Campanilla and San Jose are subject to flooding even from high-frequency events such as the 10-year flood. The SPF would result in about 10 feet of water above ground level for most of the urban developments, while the 10-year flood would produce a depth of 3 feet in many of them. The SPF inundates about 13,100 acres of land. Only 2,200 acres of this land have been developed into relatively high density urban settlements. The rest of the lands are in vacant open space (7,500 acres), agriculture (1,600 acres), and mangroves and lagoon's (1,800 acres). Under existing conditions, floodwaters would remain for over 12 hours throughout most of the floodplain, thus, creating a threat to the lives and health of the population in the area, damaging property, and disrupting all productive economic activities. Developed areas in the floodplain become inaccessible even with such floods as the 5-year event.

Per the 1993 DM, the SPF would affect over 12,300 families, most of them middle and low-middle class families, and about 330 industrial and commercial establishments. Over 93 miles of streets and roads would be impassable. Many public buildings and facilities would also be affected. There are over 345,223 people living in the drainage basin. About 47 percent live in the project area, which includes the towns of Dorado, Toa Baja, Toa Alta, and the communities of San Jose, and Mameyal. According to the 2017 Census, the populations of the towns of Dorado, Toa Baja, and Toa Alta are 37,026, 78,092, and 73,217, respectively. Historically, the main flooding damages in the study area have been associated with hurricane events and tropical storms, which generate large amount of rainfall.

The hydrologic routing model used to simulate the rainfall-runoff process and generate flow hydrographs at select locations within the simulated watershed was developed using Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) Version 3.5. The rainfall/runoff analysis focused on development of synthetic storm events with updated rainfall totals obtained from NOAA Atlas 14 Precipitation-Frequency Atlas of the United States (Volume 3, Version 3, 2006, Revised 2008).

The hydraulic routing model developed to evaluate project alternatives was developed using Hydrologic Engineering Center – River Analysis System (HEC-RAS) Version 5.0.6 with two-dimensional (2D) flow areas. The HEC-RAS model combined one-dimensional and two-dimensional (1D/2D) unsteady-flow routing simulations of the 100-year and SPF rainfall runoff events.

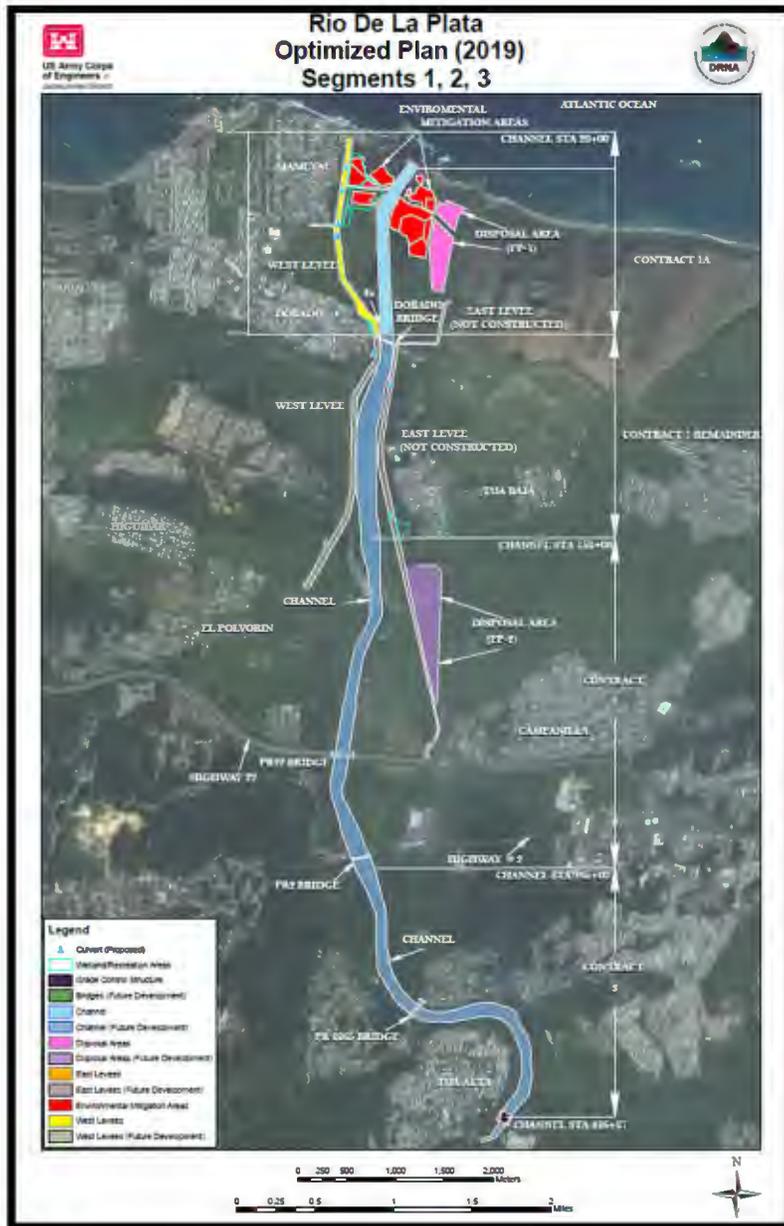


Figure 1: 2019 Optimized Plan



Figure 2: HEC-RAS Model Domain

2.2 Project Sponsor

Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, policy and legal compliance, BCOES, and IEPR reviews. However, there will not be in-kind contributions for this effort. The non-Federal sponsor for this project is the Puerto Rico Department of Natural and Environmental Resources (DNER).

Section 3

District Quality Control

3.1 Requirements

All implementation documents (including supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) shall undergo DQC in accordance EC 1165-2-217. A DQC is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements defined in the PMP. DQC shall be performed on the HEC-HMS model, HEC-RAS model and design documentation report (DDR). The District shall perform these reviews in accordance with the Jacksonville District Engineering Division Quality Management System (EN QMS) procedures.

3.2 Documentation

Review comments and responses for the DQC shall be coordinated and documented utilizing an Adobe PDF Shared Review containing the supporting documentation related to the H&H modeling. The DQC shall be certified by the H&H team member and all applicable Section and Branch Chiefs.

3.3 DQC Schedule and Estimated Cost

Although DQC is always seamless, the following milestone reviews are scheduled in Table 1. The DQC Review of the model and the DDR are already complete. The cost for the DQC was approximately \$10,000.

Project Phase/Submittal	Review Start Date	Review End Date
DQC HEC-RAS Model Review	21 September 2018	24 September 2018
DQC Final H&H DDR Review	17 October 2018	31 October 2018

Table 1: DQC Schedule

Section 4

Agency Technical Review

4.1 Requirements

All implementation documents (including supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) shall undergo ATR in accordance EC 1165-2-217. ATR reviews will occur seamlessly, including early involvement of the ATR team for validation of key design decisions, and at the scheduled milestones as shown in Section 4.6. A site visit will not be scheduled for the ATR Team. Additional data required by the ATR team will be gathered by PDT members during plan in hand visits, by USACE personnel stationed in Puerto Rico, or by non-federal team members. The information will be reviewed and disseminated to the ATR team by the PDT.

4.2 Documentation of ATR

Documentation of ATR will occur using the requirements of EC 1165-2-217. This includes the four-part comment structure and the use of DrChecksSM.

4.3 Products to Undergo ATR

Products that will undergo ATR include the HEC-HMS hydrologic routing model and associated data, the HEC-RAS hydraulic routing model and associated data, and the supporting documentation. The HEC-HMS hydrologic analysis was conducted under AE contract in 2016 as part of a task order for hydrologic and hydraulic modeling. The hydraulic analysis has since been updated with optimized project features, but it was not necessary to update the hydrologic analysis. The hydrologic analysis completed by the contractor used state of the practice assumptions and was consistent with how the Jacksonville District would have developed rainfall and applied the HEC-HMS model in 2016. Since completion of the hydrologic and hydraulic updates, a new methodology has been implemented for rainfall in Puerto Rico (as used in Rio Puerto Nuevo and Rio Grande de Arecibo Supplemental Projects). Due to the completion of all the Rio de la Plata modeling components prior to the development of the new rainfall methodology, it will not be implemented for Rio de la Plata. A separate rainfall review is not needed as part of this ATR. The ATR for the Plans, Specifications, DDR, and Geotechnical Report will be performed under the guidance of a separate review plan prepared by LRH/LRD.

4.4 Required Team Expertise and Requirements

ATR teams will be established in accordance with EC 1165-2-217. The following disciplines will be required for ATR of this project:

ATR Lead: The ATR team lead shall be a professional outside the home MSC with extensive experience in preparing Civil Works documents and conducting ATRs. The lead has the necessary skills and experience to lead a virtual team through the ATR process. The ATR lead may also serve as a reviewer for a specific discipline, in this case, Hydraulic Engineer. This individual will have a strong levee safety background, as the project involves life safety.

Hydrologist/Hydraulic Engineer: The Hydrologist/Hydraulic Engineer shall be a senior level professional with expertise in hydrologic principles and with 7 years of experience in the development and application of HEC-HMS hydrologic models. Modeling experience shall include precipitation-runoff analysis, watershed characterization, and hydrologic routing methods.

Hydraulic Engineer: The Hydraulic Engineer shall be a registered professional with expertise in engineering analysis related to flood risk management and levee safety projects. The team member shall be at least 7 years of experience in the analysis and design of hydraulic structures (e.g., spillways, outlet works, and stilling basins) and application of HEC-RAS 1D/2D hydraulic routing models. The hydraulic engineer shall be knowledgeable and experienced with the routing of inflow hydrographs through multipurpose flood control reservoirs utilizing multiple discharge devices and Corps application of risk and uncertainty analyses in flood damage reduction studies.

4.5 Statement of Technical Review Report

At the conclusion of each ATR effort, the ATR team will prepare a Statement of Technical Review Report with a completion and certification memo. The report will be prepared in accordance with EC 1165-2-217 and will follow the most recent template developed by the RMC.

4.6 ATR Schedule and Estimated Cost

Although ATR is always seamless, the preliminary ATR milestone schedule is listed in Table 2. The cost for the ATR is approximately \$12,000.

Project Phase/Submittal	Review Start Date	Review End Date	Site Visit
ATR Final Model Review	25 February 2019	8 March 2019	NA

Table 2: ATR Schedule

Section 5 Safety Assurance Review

A Safety Assurance Review (SAR), also known as a Type II Independent External Peer Review (IEPR), is not recommended for the H&H products associated with the Rio de la Plata Project. The determination as to whether or not a SAR is required for the implementation documents for the remaining construction contracts will be completed under the guidance of a separate Review Plan. This Review Plan will be prepared by the Corps of Engineers Huntington District (LRH) and approved by the Great Lakes and Ohio River Division (LRD) during the design phase since LRH will be responsible for the preparation of the Plans, Specifications, and DDR. Because the DDR will include results from the H&H analysis covered under this Review Plan, these results can be reviewed during the SAR if required. Therefore, a SAR will not be completed for this H&H analysis independently.

Section 6 Public Posting of Review Plan

As required by EC 1165-2-217, the approved RP will be posted on the District public website (<https://www.saj.usace.army.mil/Missions/Civil-Works/Review-Plans/>). This is not a formal comment period, and there is no set timeframe for the opportunity for public comment. If and when comments are received, the PDT will consider them and decide if revisions to the RP are necessary.

Section 7 Review Plan Approval and Updates

The MSC Commander, or delegated official, is responsible for approving this RP. The Commander's approval reflects vertical team input (involving the District, MSC, and RMC) as to the appropriate scope, level of review, and endorsement by the RMC. The RP is a living document and should be updated in accordance with 1165-2-217. All changes made to the approved RP will be documented in Attachment 1, Table 5, Attachment 2RP Revisions. The latest version of the RP, along with the Commander's approval memorandum, will be posted on the District's webpage and linked to the HQUSACE webpage. The approved RP should be provided to the RMO.

Section 8

Engineering Models

The use of certified, validated, or agency approved engineering models is required for all activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to DQC, ATR, BCOES, policy and legal review, and SAR (if required). Where such approvals have not been completed, appropriate independent checks of critical calculations will be performed and documented. The following engineering models, software, and tools are anticipated to be used:

Model Name	Version	Validation Date
HEC-RAS	5.0.6	HH&C CoP Approved
HEC-HMS	4.3	HH&C CoP Approved

Table 3: Models and Status

Section 9

Review Plan Points of Contact

Title	Organization	Phone
Review Manager	CESAJ-EN-Q	[REDACTED]
Senior Reviewer	CEIWR-RMC	[REDACTED]
Quality Manager	CESAD-RBT	[REDACTED]

Table 3: RP POC's

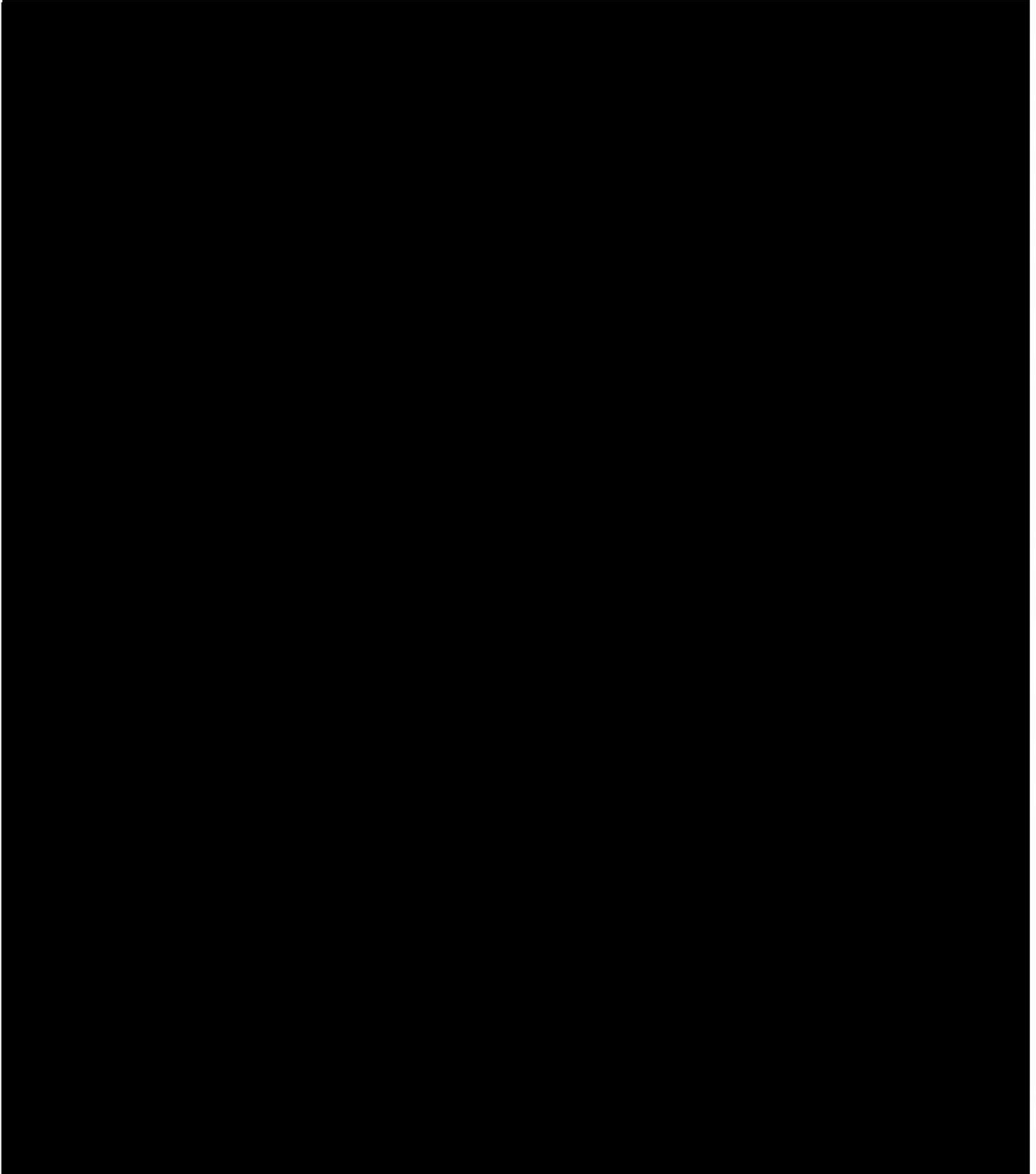
ATTACHMENT 1

Review Plan Revisions

Revision Date	Description of Change	Page/Paragraph Number

Table 5: RP Revisions

ATTACHMENT 2



ATTACHMENT 3

