



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

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 Puerto Nuevo 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 1986, Public Law 99-662, 17 Nov 86.

2. I hereby request approval of the enclosed Review Plan for the Rio Puerto Nuevo 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



COL, EN
Commanding



US Army Corps
of Engineers®

Prepared by:
SAJ District
SAD Division

Rio Puerto Nuevo Project Hydrology and Hydraulic Products

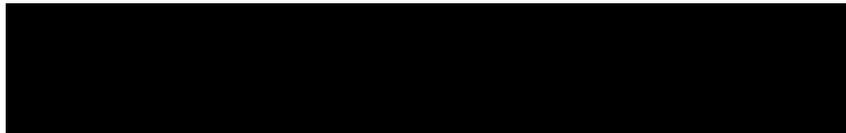
Review Plan

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 Puerto Nuevo Project (P2# 113454) will help ensure a quality-engineering project is developed by the U.S. Army Corps of Engineers (USACE) 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 H&H products of the Rio Puerto Nuevo Project. Products include an HEC-RAS hydraulic routing model, a HEC-HMS hydrologic routing model, and a rainfall development methodology for synthetic, frequency based storms using NOAA Atlas 14. The results of this review will be provided as a reference in subsequent project reviews of the design phase implementation documents, including the plans and specifications (P&S) and the Design Documentation Report (DDR). 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 Puerto Nuevo 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
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- EM 1110-2-1913 Design, Construction, and Evaluation of Levees, 30 April 2000
- 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, 30 April 2014

- 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
- 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
- Project Management Plan (PMP) for Rio Puerto Nuevo Project (P2# 113454)

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 Bipartisan Budget Act of 2018 (Public Law 115-123), enacted 9 February 2018, provided funding in support of recovery efforts following Hurricanes Harvey, Irma, and Maria, including funding for the continued construction of the Rio Puerto Nuevo Project. The project is located in San Juan, Puerto Rico. The project encompasses a densely developed drainage basin with a population of approximately 151,000 residents in the San Juan Metropolitan Area along the north coast of Puerto Rico. The basin drains an area of 26 square miles and includes Quebrada Margarita, Bechara Canal, Quebrada Josefina, Quebrada Doña Ana, Quebrada Buena Vista, and Quebrada Guaraacanal tributaries. Flooding is a serious threat to a significant portion of the population and economic activity in the San Juan Metropolitan Area. The Rio Puerto Nuevo basin is subject to severe flash flooding that can be attributed to inadequate channel capacity, flow limitations at numerous bridges, increased stormwater runoff from impervious surfaces and flood storage losses due to intense urbanization encroachments into the flood plain.

The authorized project consists of improvements to 11.2 miles of Rio Puerto Nuevo and its tributaries. The project includes 1.66 miles of bulkheaded trapezoidal channel, 9.54 miles of concrete rectangular channel, 5.1 miles of which are high velocity, and 2,160 feet of double box culvert(s). Additional features include two baffle pier stilling areas, two high velocity flow junctions with tributary streams, Buena Vista Diversion Channel and Guaraacanal Channel, two upstream debris basins with side-overflow spillways, and numerous other features and project relocations including bridge replacements and modifications.

Cumulatively, the authorized project is approximately 25 percent complete. Due to the project's large scope and real estate requirements, segmentation of project construction allowed for incremental fiscal appropriations and real estate certifications. Table 1 shows the status of the project construction contracts.

The hydrologic routing model used to determine the appropriate basin runoff was developed using Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) Version 4.3 and HEC GeoHMS 10.4. The rainfall/runoff analysis will focus on synthetic storm events to match the previously authorized project analysis with updated rainfall totals based on Atlas 14 rainfall.

Rainfall development for the synthetic storm events, including spatial distribution within the defined watershed and temporal distribution within the 24-hour storm duration, was based on NOAA Atlas 14 depth-duration-frequency data for Puerto Rico and the National Resource Conservation Service (NRCS) methodology for applying that data. This rainfall was then applied to the HEC-HMS rainfall-runoff model in order to develop flow hydrographs at selected locations in the simulated watershed.

The hydraulic routing model used 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-yr and SPF rainfall runoff events.

Construction Contract Number	Contract	Description	Construction Status as of 2018
N/A	1	Lower Rio Puerto Nuevo channel (mouth of river)	Complete
N/A	1A	Kennedy Bridge modifications	Complete
N/A	2A	Lower Margarita Channel	Complete
N/A	2AR	Completion of 2A work including channel excavation	Complete
N/A	2AA	Bechara Industrial Area and Bechara Mid-Section	Complete
2	2B	Roosevelt Bridge	Not Initiated
N/A	2C1	Lower Margarita Channel and Stilling Basin	In-Progress
1	2C2	Upper Margarita Channel including sewer line relocation	Not Initiated
1	2C3	Upper Margarita Channel completion including U-Frame channel ties to 2C1	Not Initiated
3	2D	Lower Rio Puerto Nuevo Subcritical Channel walls	In-Progress
N/A	2D1	DeDiego Bridge Seismic Retrofit	Complete
3	2E	Lower Rio Puerto Nuevo Subcritical Channel bottom	Not Initiated
7	3A	Bridge replacement of 10 bridges	Not Initiated
5	3AA	Bridge replacement – Pinero Avenue West	Not Initiated
7	3B-1	Quebrada Josefina and Stilling Basins	Not Initiated
7	3B-2	Quebrada Dona Ana tributary channels and Stilling Basins	Not Initiated
4	4A	Bridge Modifications (Las Americas, Pinera Ave, NE Access ramp, SE Access ramp)	Not Initiated
5	4B	Bridge replacement – Notre Dame st bridge	Not Initiated
6	4	Middle Main Channel – Sta 147+40 to Sta 206+50	Not Initiated
6	4D-1	Buena Vista Bridges – 2 bridge replacements	Not Initiated
6	4D-2	Buena Vista Diversion Channel	Not Initiated
8	5A	New PR 1 Highway Bridge	Not Initiated
6	5B-1	Middle Puerto Nuevo Channel (Sta 206+50 to PR HWY 1) and Debris basin	Not Initiated
8	5B-2	Middle Main Channel – PR Highway 1 to Sta 271+50	Not Initiated
8	6	Upper Reach 1 Bridge replacement and 1 bridge foundation modification	Not Initiated

Table 1: Status of Construction Contracts for Rio Puerto Nuevo Project

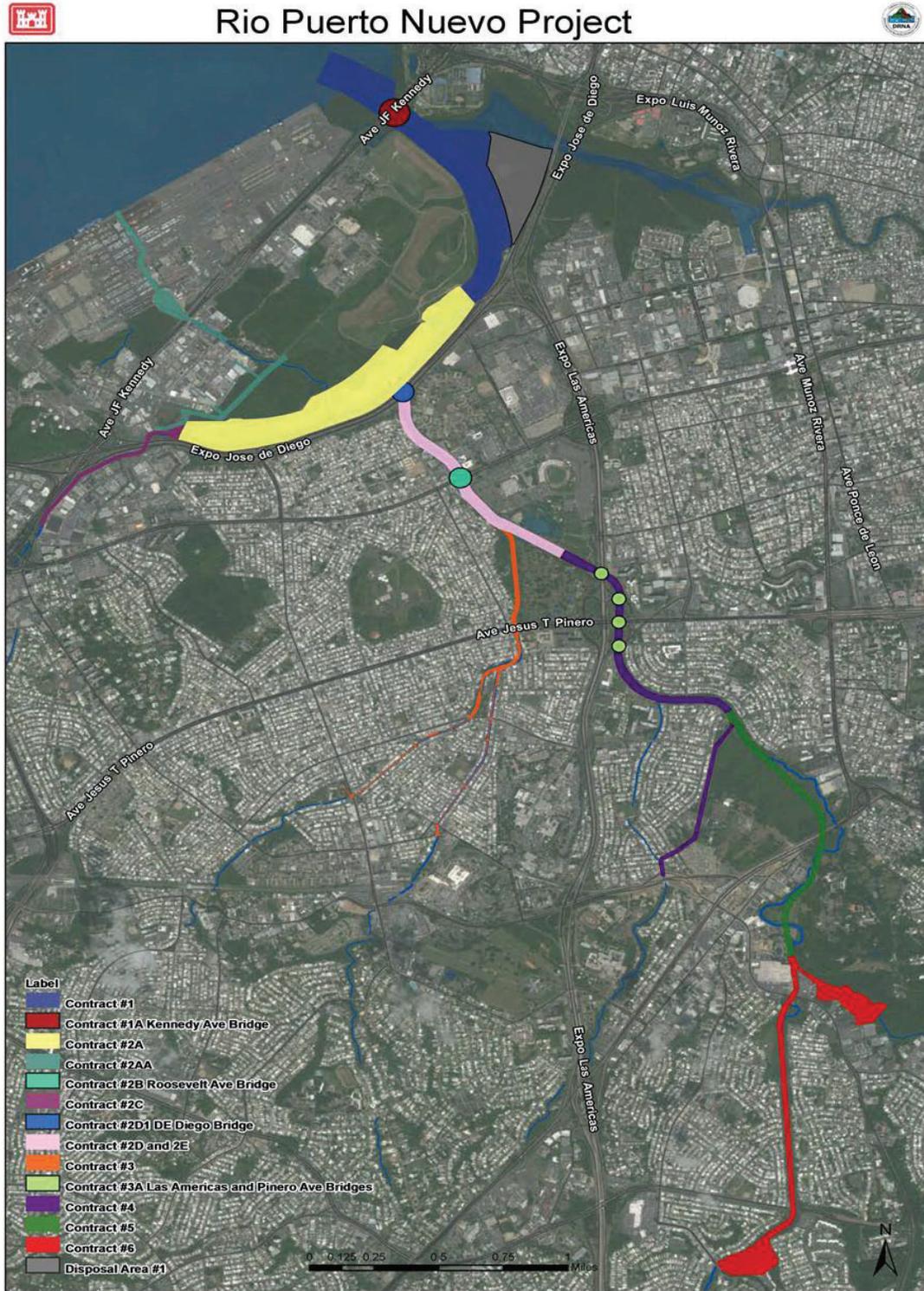


Figure 1: Contract Locations

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 SAR 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 District Quality Control (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 will be performed on the HEC-HMS at the final stage of development and on the HEC-RAS models at the 25%, 50%, 75%, and final stages of development. 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 review will be coordinated and documented utilizing an Adobe PDF Shared Review containing the supporting documentation related to the H&H models. The DQC shall be QC certified by the H&H team members 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 2 for HEC-HMS and Table 3 for HEC-RAS. The cost for the DQC is approximately \$17,000.

Project Phase/Submittal	Review Start Date	Review End Date
DQC Final Model Review	28 January 2019	01 February 2019

Table 2: DQC Schedule – HEC-HMS Model

Project Phase/Submittal	Review Start Date	Review End Date
DQC 25% Model Review	24 September 2018	28 September 2018
DQC 50% Model Review	04 February 2019	08 February 2018
DQC 75% Model Review	11 April 2019	17 April 2019
DQC Final Model Review	02 May 2019	09 May 2019

Table 3: DQC Schedule – HEC-RAS Model

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 an Agency Technical Review (ATR) in accordance with 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. ATR will be performed on the synthetic design storm development and HEC-HMS model for final review and on the HEC-RAS model at the 50% and final stages of development. A preliminary technical review has already been performed by a member of the Hydrologic Hazards Team (HHT) for the synthetic design storm development. Therefore, the ATR will confirm the prior review in order to obtain formal ATR certification of the methodology. 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, either 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 a rainfall development methodology for synthetic, frequency based storms using NOAA Atlas 14, the HEC-HMS hydrologic routing model and associated data, the HEC-RAS hydraulic routing model and associated data, and the supporting documentation for each.

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 located 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, Hydrologist and/or Hydraulic Engineer.

Meteorologist: The Meteorologist shall have at least 7 years of experience in the analysis of hydro-meteorological data and in the use of numerical, physics-based weather models, including the ability to make informed predictive forecasts of weather and hydro-meteorological events that can affect USACE projects and interests. Experience shall include the development of spatial and temporal distributions of rainfall based on analysis of historical, forecast and stochastic precipitation data. The meteorologist shall be knowledgeable and experienced with the development of Probable Maximum Precipitation events using an array of standard and accepted guidance as well as site-specific hydrology.

Hydrologist/Hydraulic Engineer – The Hydrologist/Hydraulic Engineer shall be a registered professional with expertise in hydrologic principles and at least 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 have 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.

If a team member can be located that possesses the required expertise for both the Hydrologist and Hydraulic Engineer, that team member may serve in both positions.

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 4 for the HEC-HMS and Table 5 for the HEC-RAS. The total cost for both ATRs is approximately \$29,000.

Project Phase/Submittal	Review Start Date	Review End Date	Site Visit
ATR Final Model Review / Rainfall Methodology	4 March 2019	8 March 2019	NA

Table 4: ATR Schedule – HEC-HMS

Project Phase/Submittal	Review Start Date	Review End Date	Site Visit
ATR 50% Model Review	4 March 2019	8 March 2019	NA
ATR Final Model Review	03 June 2019	14 June 2019	NA

Table 5: ATR Schedule - HEC-RAS

Section 5

Safety Assurance Review

5.1 Decision on SAR

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 Puerto Nuevo 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 RP. This RP will be prepared by the USACE Jacksonville District (SAJ) and approved by South Atlantic Division (SAD) during the design phase since SAJ will be responsible for preparation of the Plans, Specifications, and DDR. Because the DDR will include the results of the H&H analyses covered under this RP, these results can be reviewed during a 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 8, RP 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, and policy and legal review. 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
HEC-GeoHMS	10.4	HH&C CoP Approved

Table 6: Models and Status

Section 9

Review Plan Points of Contact

Title	Organization	Phone
Review Manager	CESAJ-EN-T	██████████
Senior Reviewer	CEIWR-RMC	██████████
Quality Manager	CESAD-RBT	██████████

Table 7: RP Points of Contact

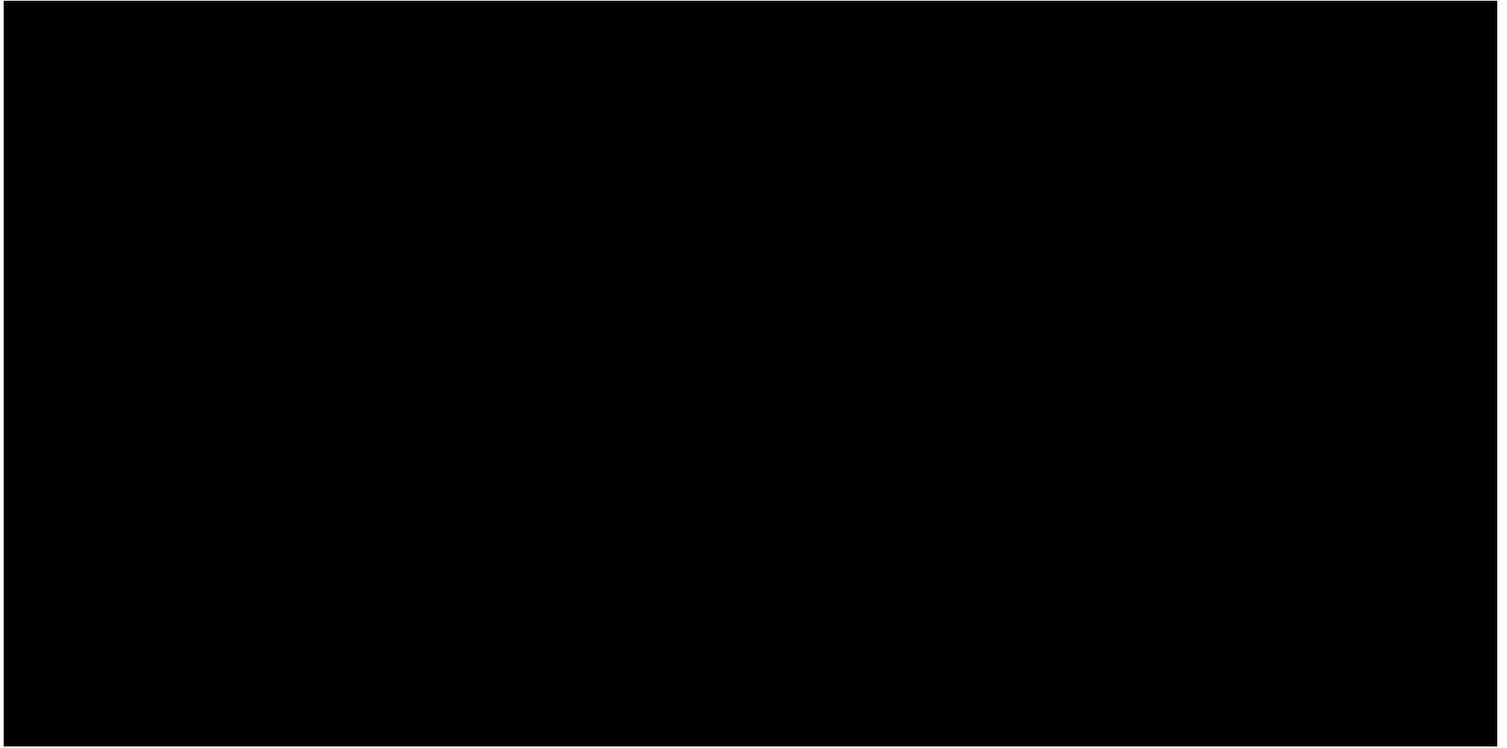
ATTACHMENT 1

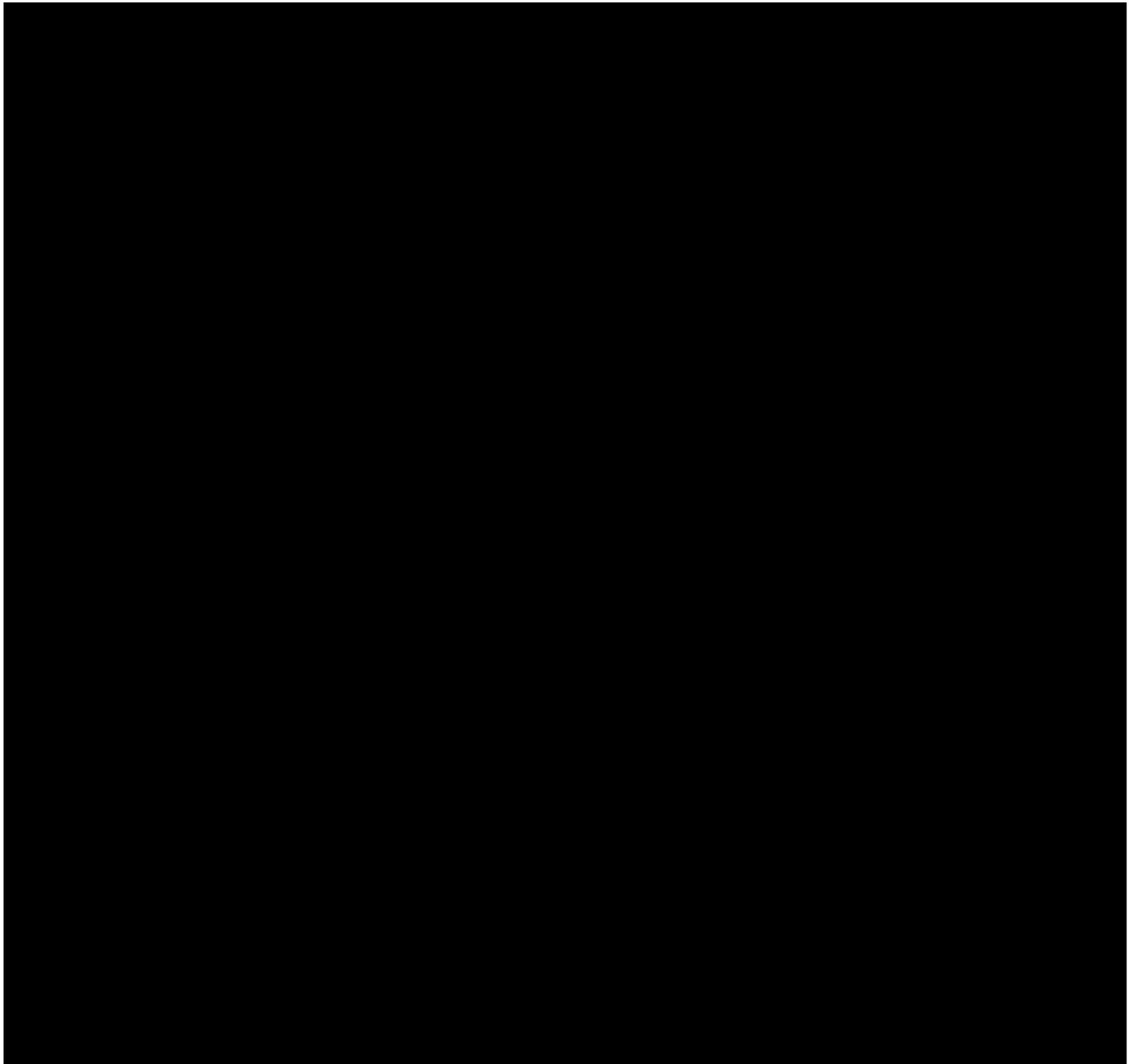
Review Plan Revisions

Revision Date	Description of Change	Page/Paragraph Number

Table 8: RP Revisions

ATTACHMENT 2





ATTACHMENT 3

