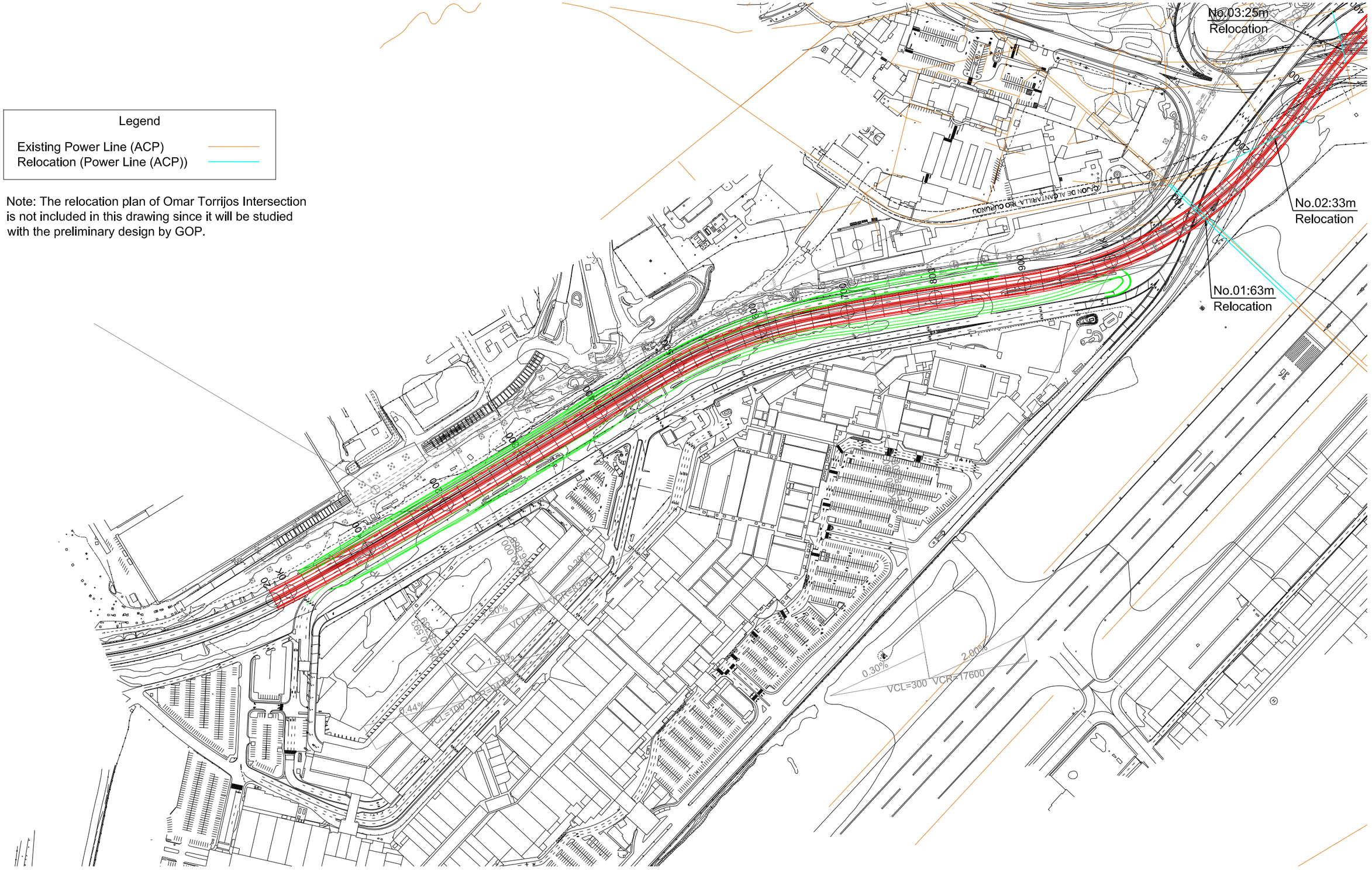
付属資料 6:　既存設備位置図・移設計画図
(第 4 パナマ運河橋)

Location of Existing Utilities and Relocation Plan (Power Line) (1 of 5)

Legend

Existing Power Line (ACP)
Relocation (Power Line (ACP))

Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.



SECRETARIA DEL METRO DE PANAMÁ

JAPAN INTERNATIONAL COOPERATION AGENCY

THE FEASIBILITY STUDY ON PANAMA CITY URBAN TRANSPORTATION LINE-3 PROJECT

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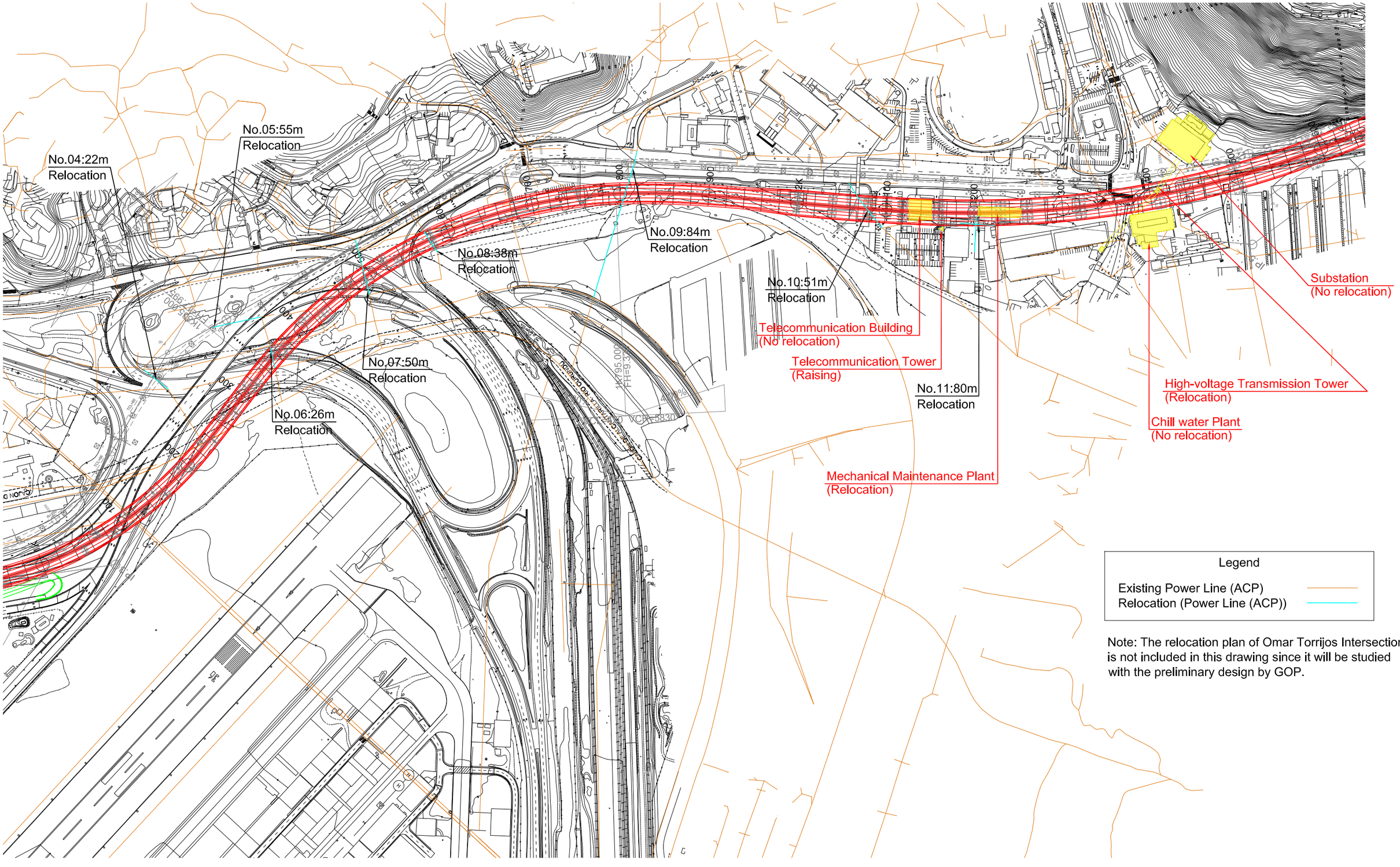
REMARKS:

Location of Existing Utilities and Relocation Plan (Power Line) (1 of 5)

Location of Existing Utilities and Relocation Plan (Power Line) (2 of 5)



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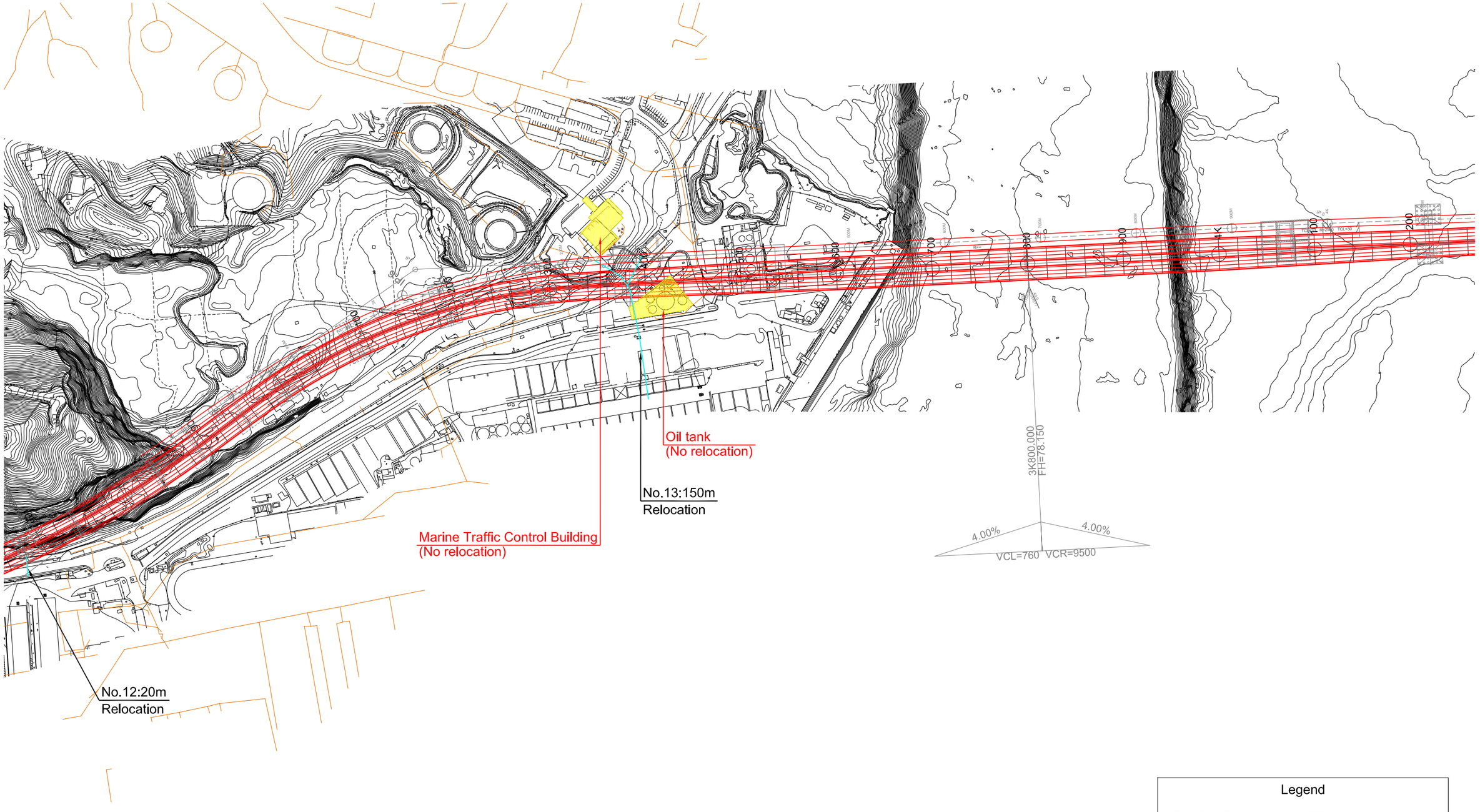
Location of Existing Utilities and Relocation Plan (Power Line) (2 of 5)

Location of Existing Utilities and Relocation Plan (Power Line)　(3 of 5)



Legend

- Existing Power Line (ACP)
- Relocation (Power Line (ACP))

Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.

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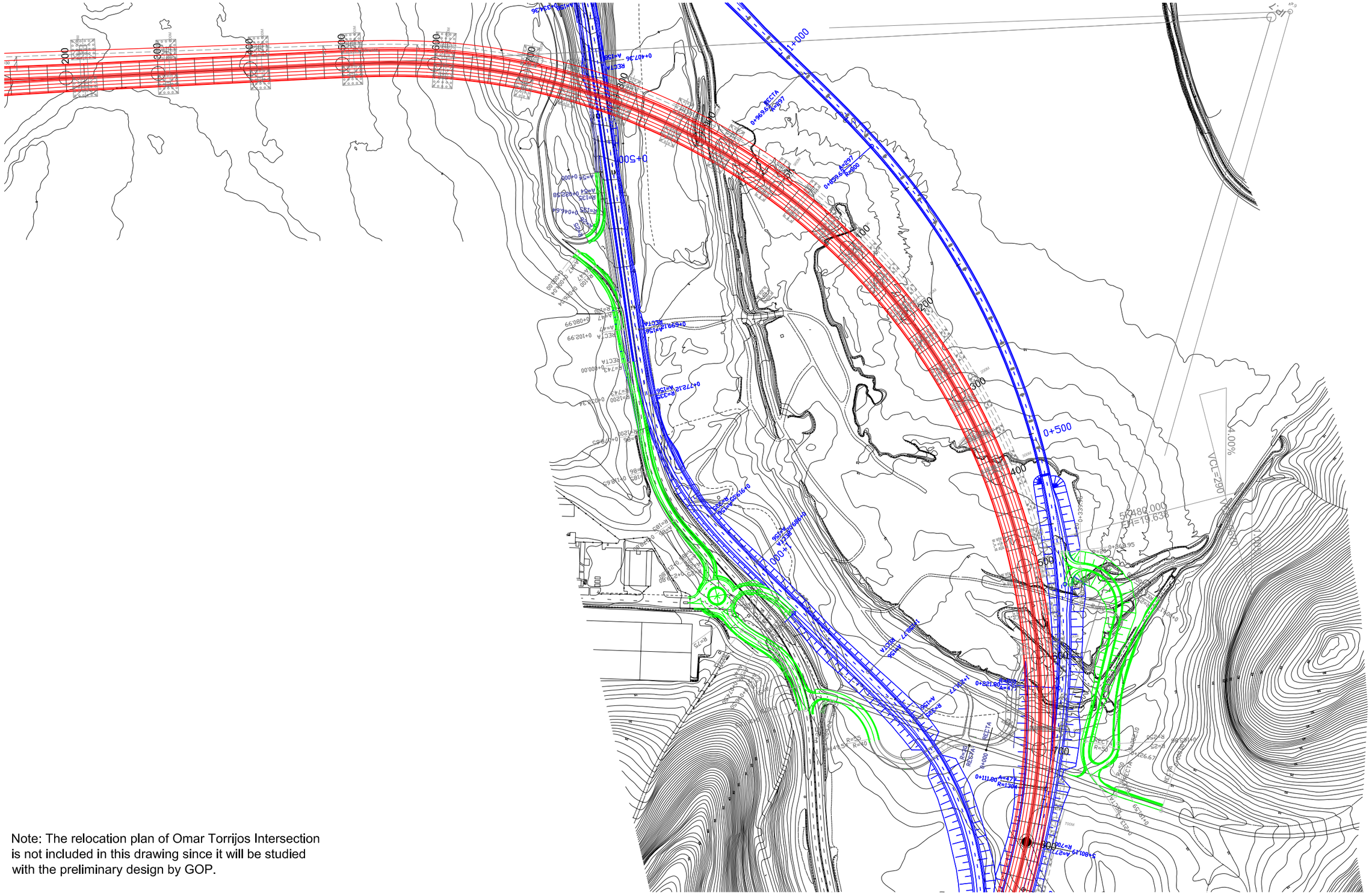
Location of Existing Utilities and Relocation Plan (Power Line) (4 of 5)



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METRO DE PANAMA — SECRETARIA DEL METRO DE PANAMÁ	JICA — JAPAN INTERNATIONAL COOPERATION AGENCY	THE FEASIBILITY STUDY ON PANAMA CITY URBAN TRANSPORTATION LINE-3 PROJECT				REMARKS:
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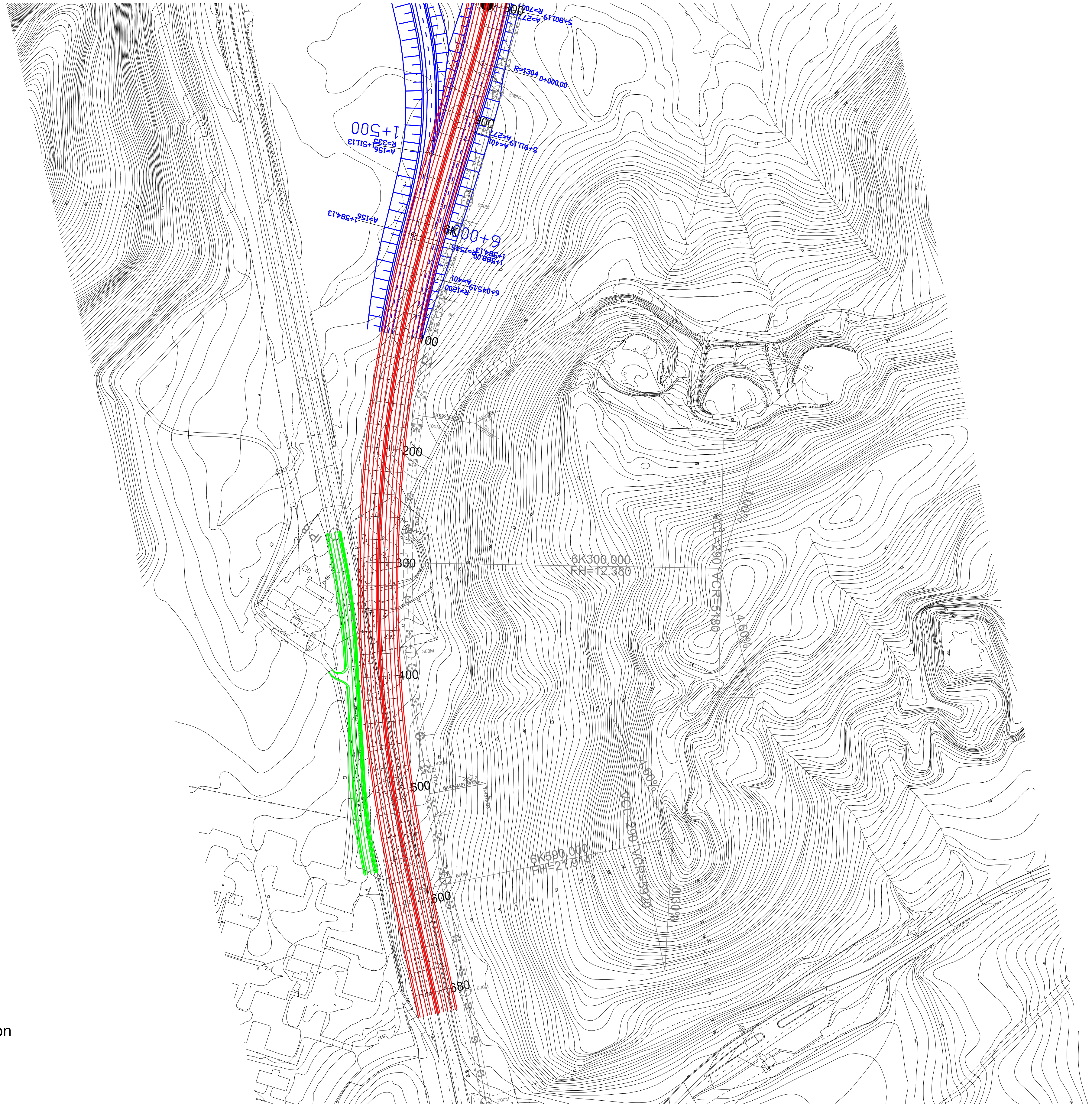
Location of Existing Utilities and Relocation Plan (Power Line) (5 of 5)



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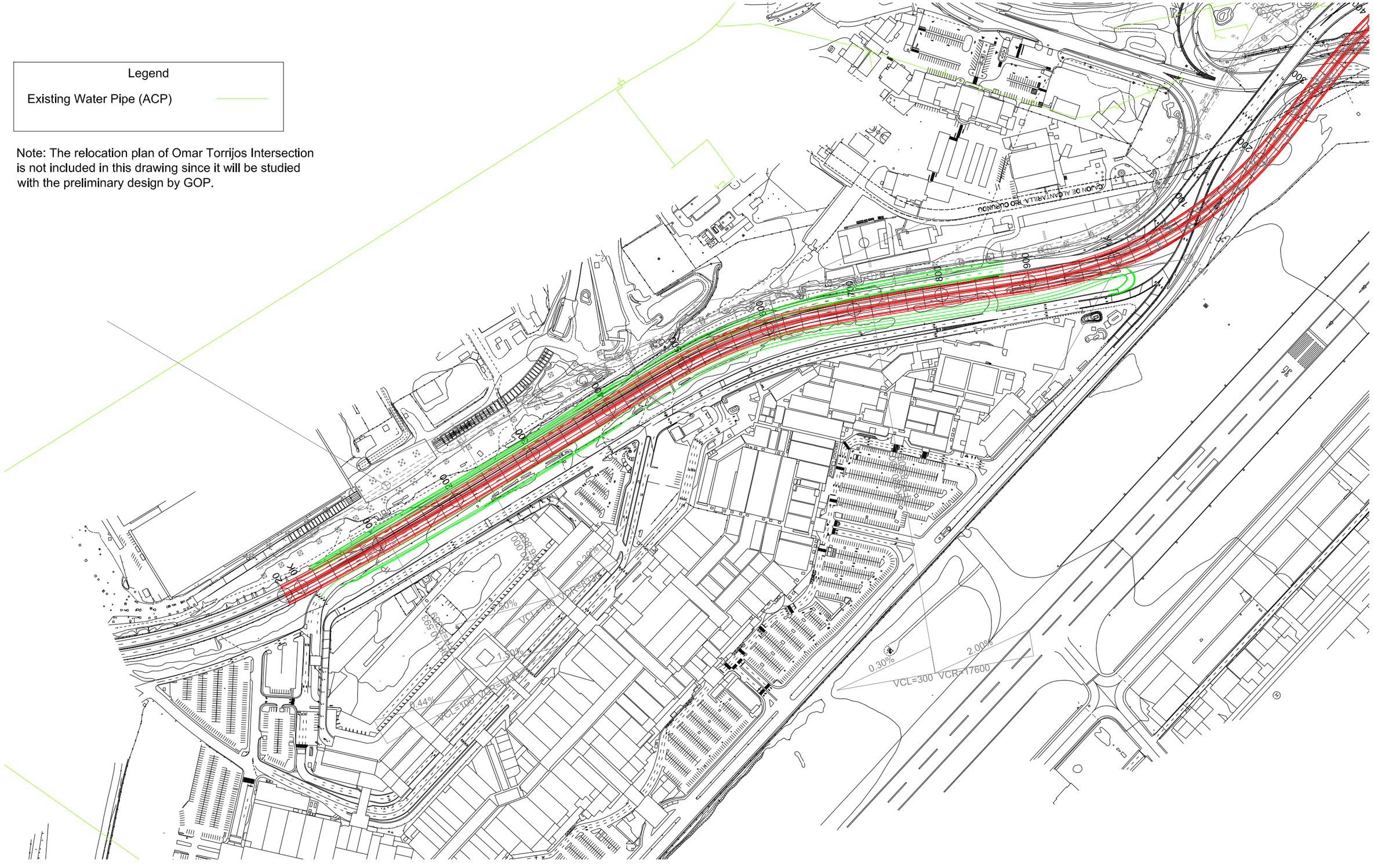
DRAWN:	DATE: May 2014	RECEIVED BY: TEAM LEADER/URBAN RAILWAY PLANNING	SUBMITTED BY: CIVIL AND FACILITY PLANNING	CHECKED BY:	PAGE: 5/5
DESIGNED:	SCALE: S=1:4,000			APPROVED BY:	

Location of Existing Utilities and Relocation Plan (Water Pipe) (1 of 5)

Legend

Existing Water Pipe (ACP)

Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.



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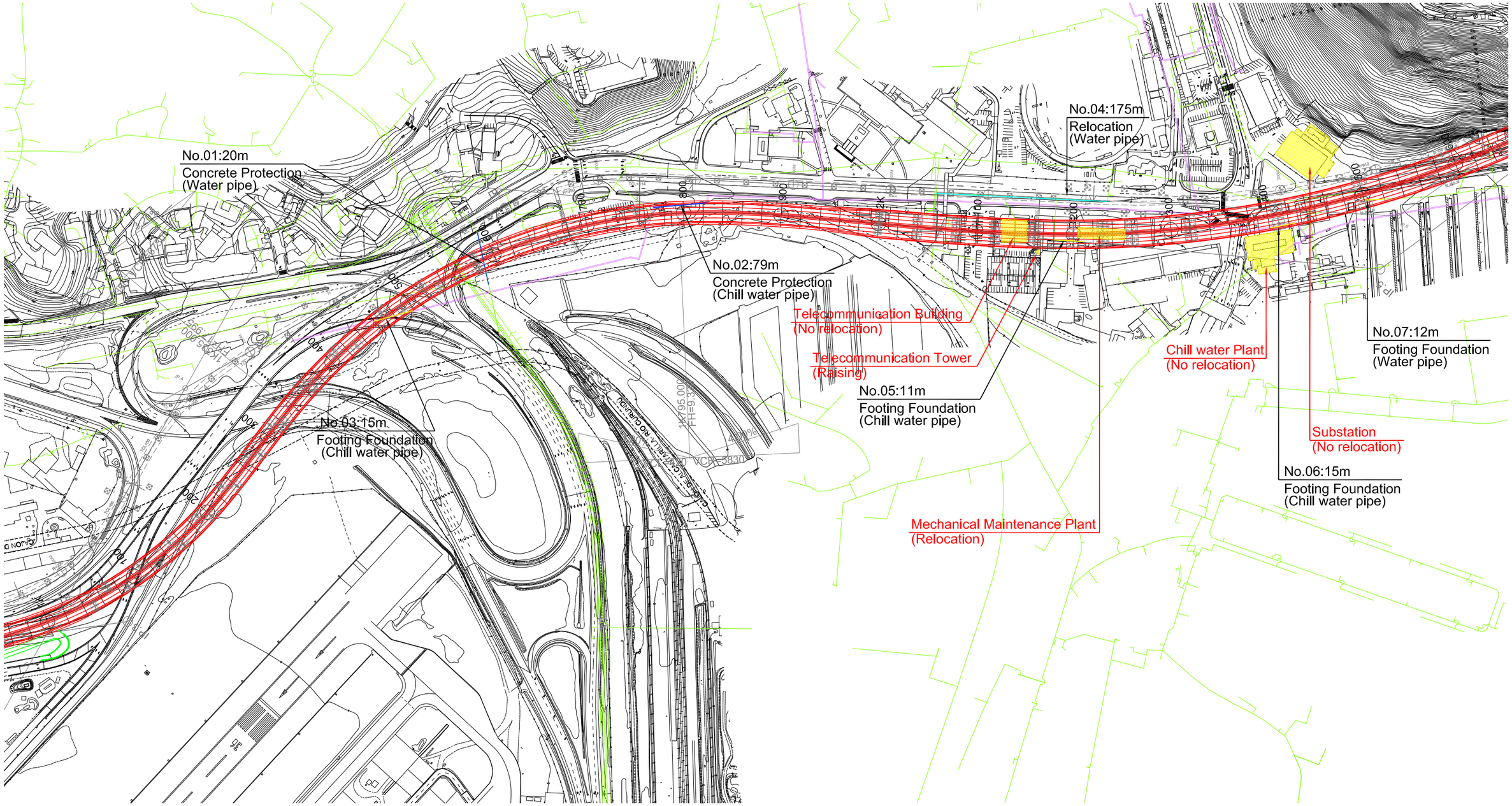
Location of Existing Utilities and Relocation Plan (Water Pipe) (1 of 5)

Location of Existing Utilities and Relocation Plan (Water Pipe) (2 of 5)



Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.

Legend

- Existing Water Pipe (ACP)
- Existing Chill Water Pipe (ACP)
- Relocation (Water Pipe (ACP))
- On Footing Foundation (Water Pipe/ Chill Water Pipe (ACP))
- Concrete Protection (Water Pipe/ Chill Water Pipe (ACP))

SECRETARIA DEL METRO DE PANAMÁ

JAPAN INTERNATIONAL COOPERATION AGENCY

THE FEASIBILITY STUDY ON PANAMA CITY URBAN TRANSPORTATION LINE-3 PROJECT

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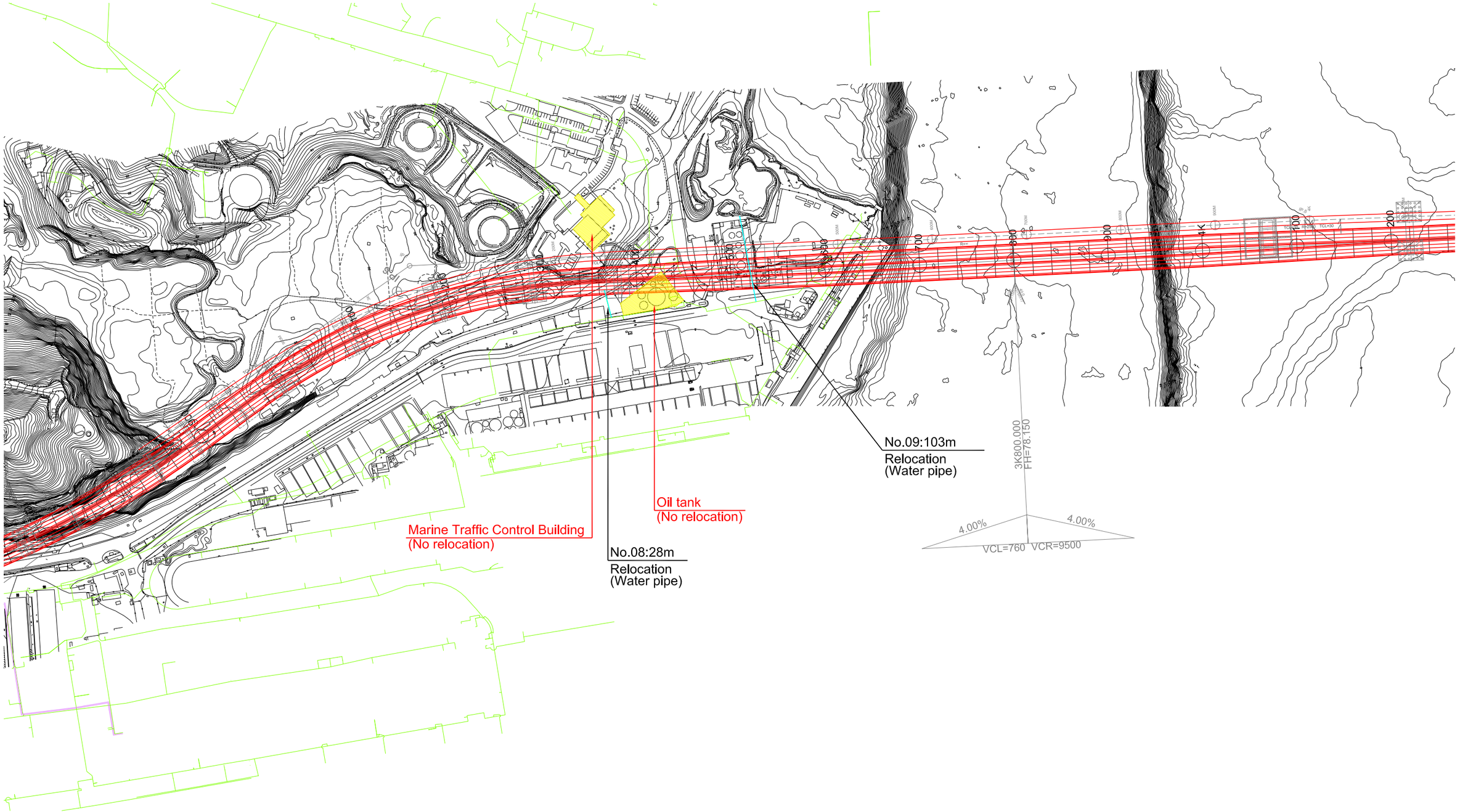
REMARKS:

Location of Existing Utilities and Relocation Plan (Water Pipe) (2 of 5)

Location of Existing Utilities and Relocation Plan (Water Pipe) (3 of 5)



Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.

Legend

- Existing Utilities (Water pipe)
- Existing Utilities (Chill water pipe)
- Relocation Utilities

SECRETARIA DEL METRO DE PANAMÁ

JAPAN INTERNATIONAL COOPERATION AGENCY

THE FEASIBILITY STUDY ON PANAMA CITY URBAN TRANSPORTATION LINE-3 PROJECT

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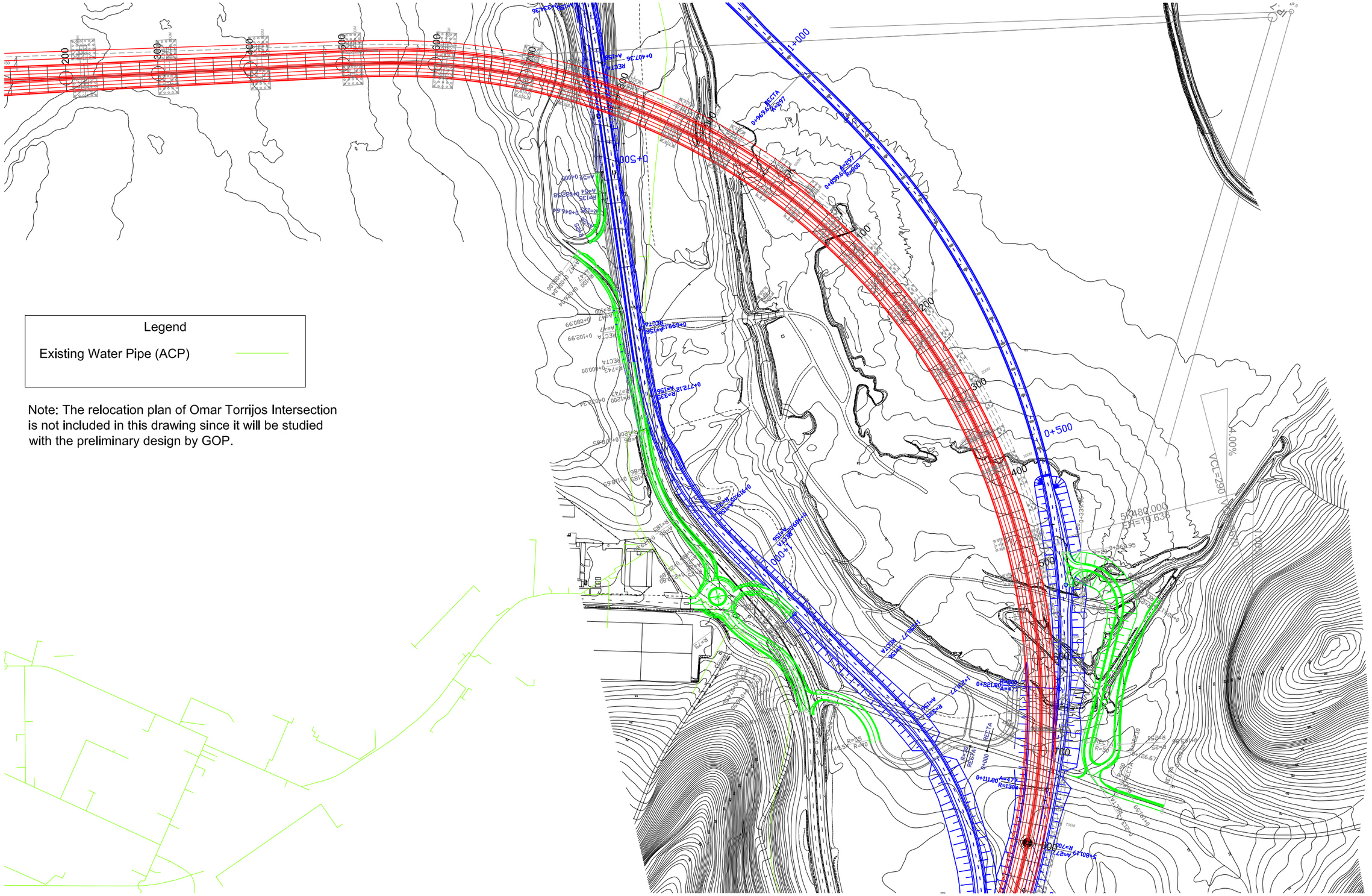
REMARKS:

Location of Existing Utilities and Relocation Plan (Water pipe) (3 of 5)

Location of Existing Utilities and Relocation Plan (Water Pipe) (4 of 5)



Legend

Existing Water Pipe (ACP)

Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.

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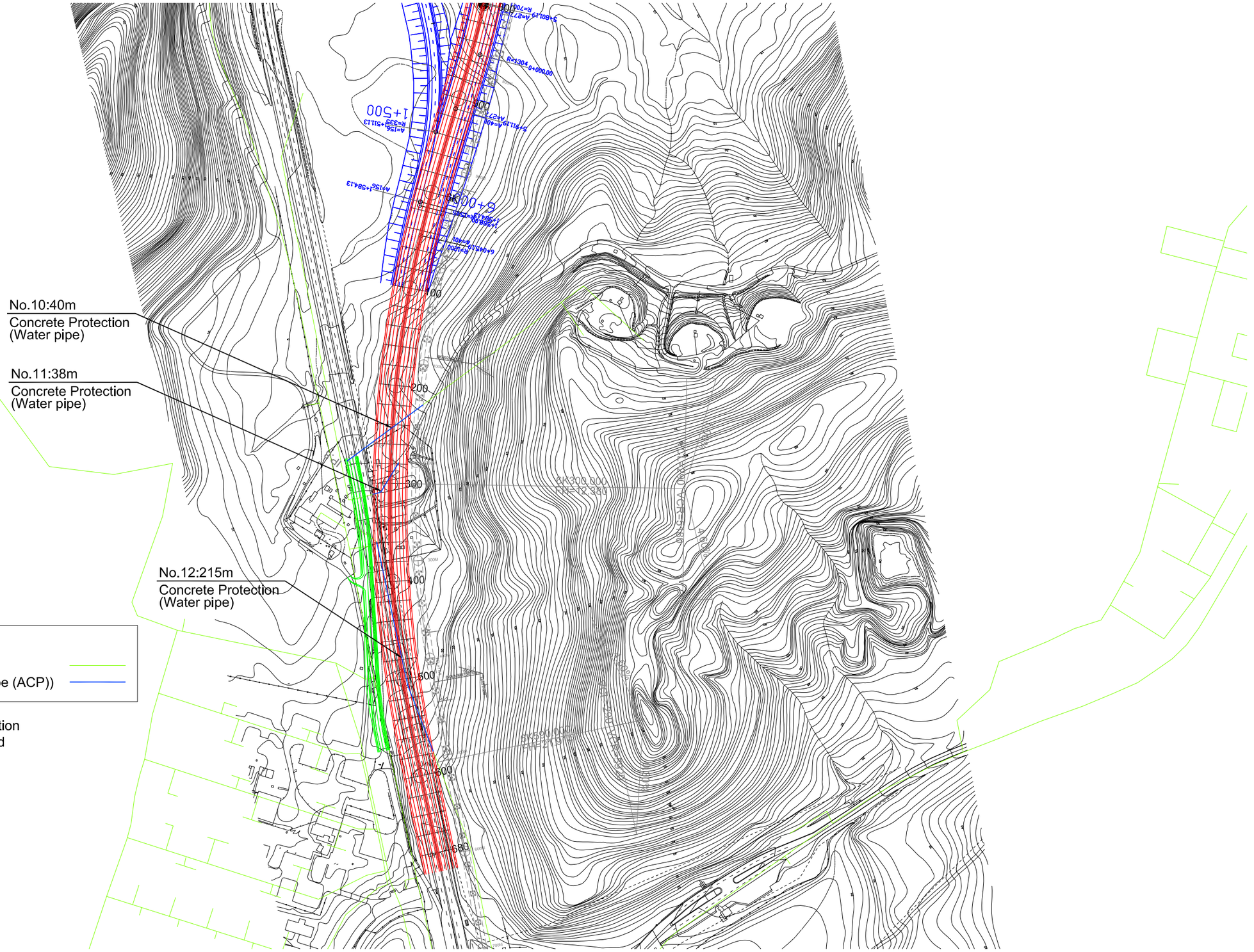
DESIGNED:	SCALE: S=1:4,000	TEAM LEADER/URBAN RAILWAY PLANNING	CIVIL AND FACILITY PLANNING	APPROVED BY:	4 / 5	

Location of Existing Utilities and Relocation Plan (Water Pipe) (5 of 5)



Legend

Existing Water Pipe (ACP)

Concrete Protection (Water Pipe/ Chill Water Pipe (ACP))

Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.

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REMARKS:

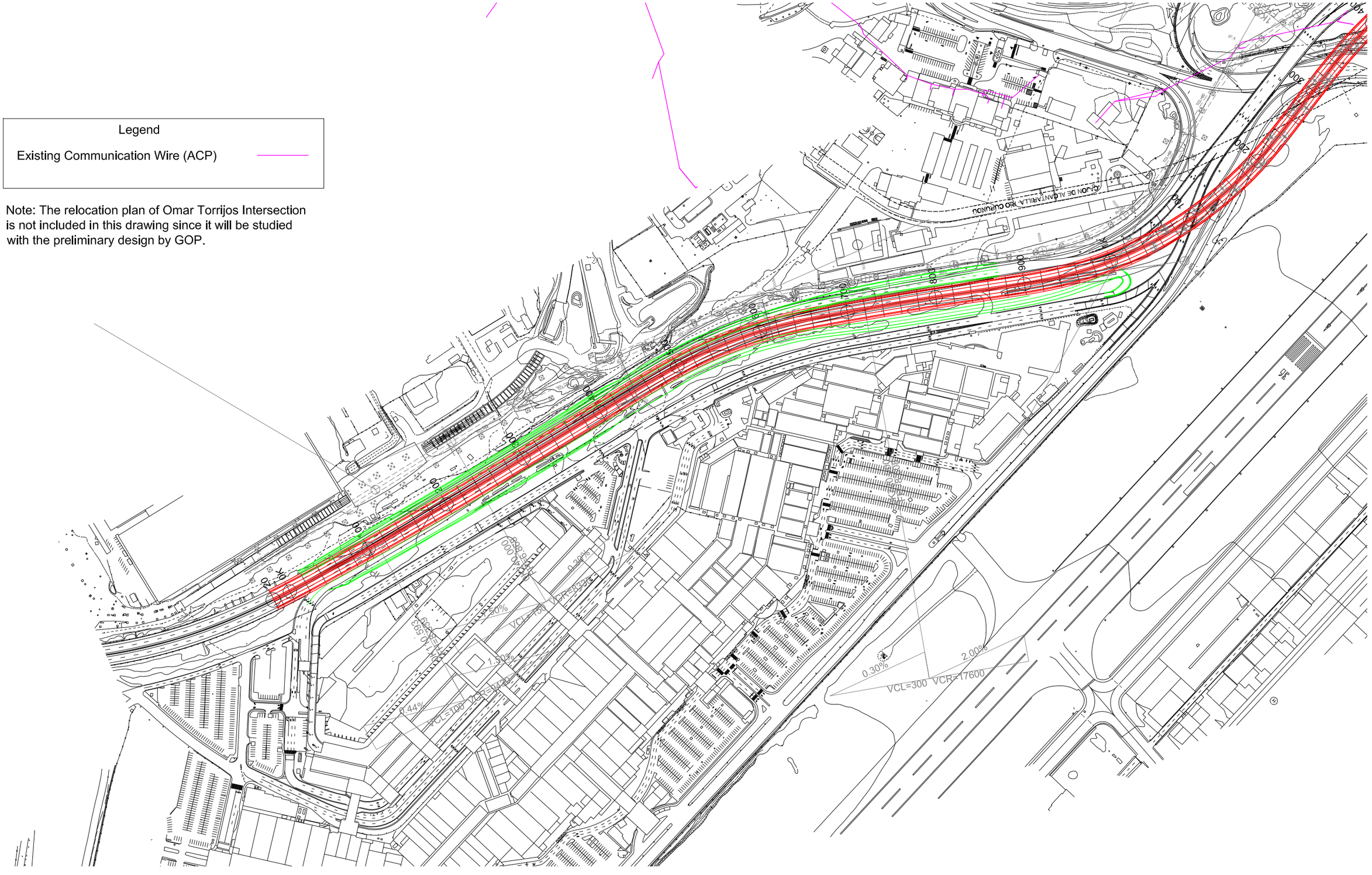
Location of Existing Utilities and Relocation Plan (Water Pipe) (5 of 5)

Location of Existing Utilities and Relocation Plan (Communication wire) (1 of 5)

Legend

Existing Communication Wire (ACP)

Note: The relocation plan of Omar Torrijos Intersection is not included in this drawing since it will be studied with the preliminary design by GOP.



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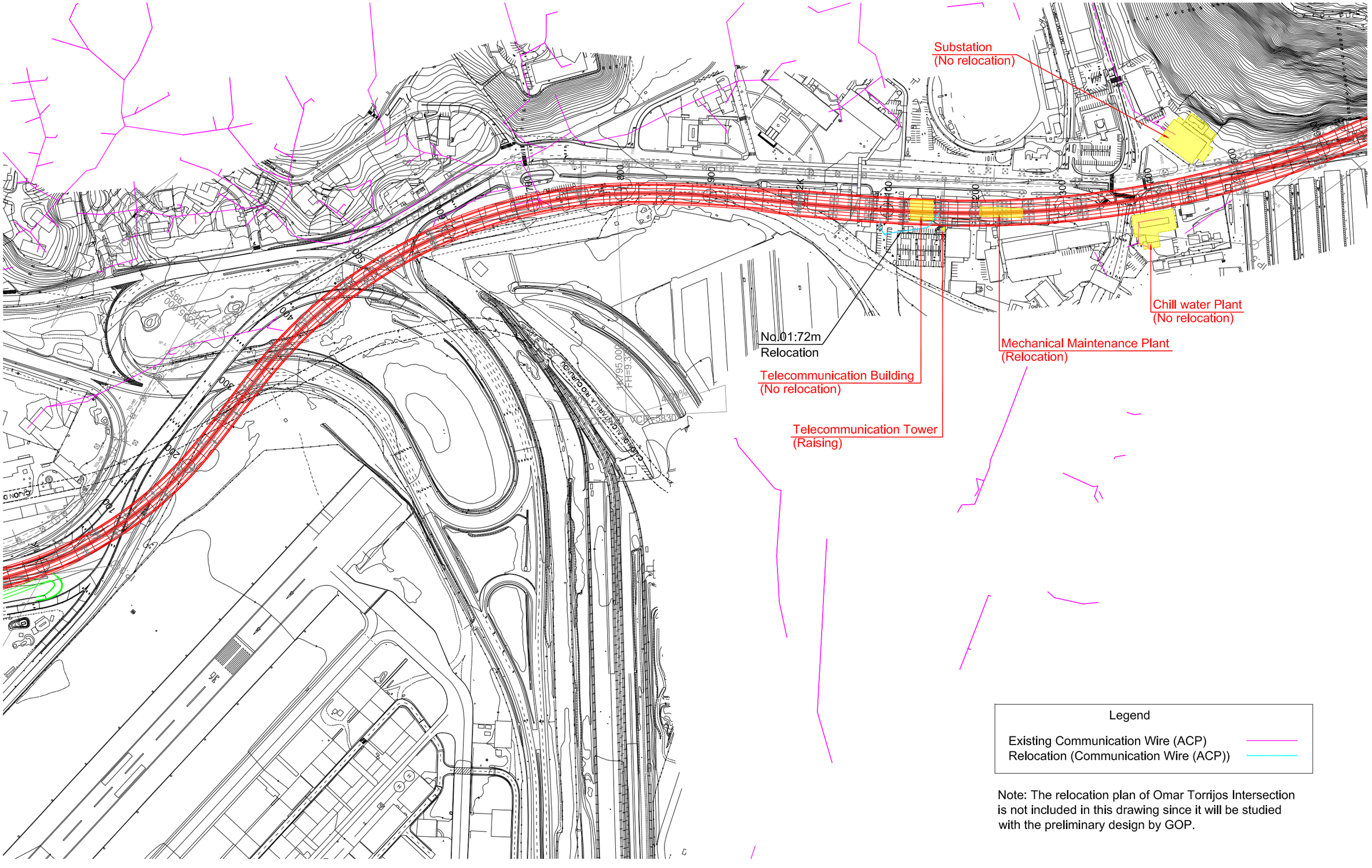
		DRAWN:	DATE: May 2014	RECEIVED BY:	SUBMITTED BY:	CHECKED BY:	PAGE: 1/5	Location of Existing Utilities and Relocation Plan (Communication wire) (1 of 5)
		DESIGNED:	SCALE: S=1:4,000	TEAM LEADER/URBAN RAILWAY PLANNING	CIVIL AND FACILITY PLANNING	APPROVED BY:	

Location of Existing Utilities and Relocation Plan (Communication wire) (2 of 5)



Legend

Existing Communication Wire (ACP)

Relocation (Communication Wire (ACP))

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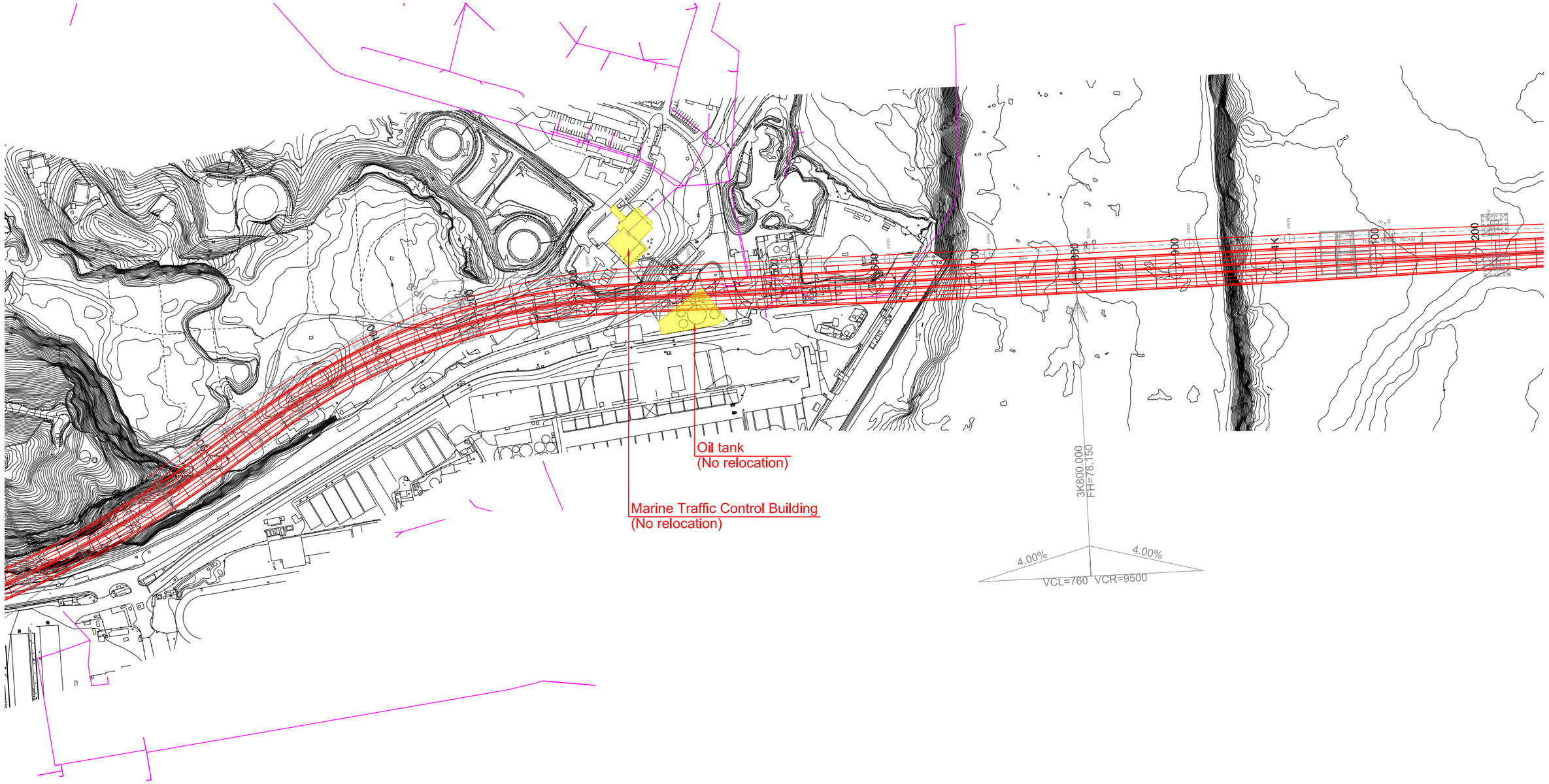
Location of Existing Utilities and Relocation Plan (Communication wire) (2 of 5)

Location of Existing Utilities and Relocation Plan (Communication wire) (3 of 5)



Legend

Existing Communication Wire (ACP)

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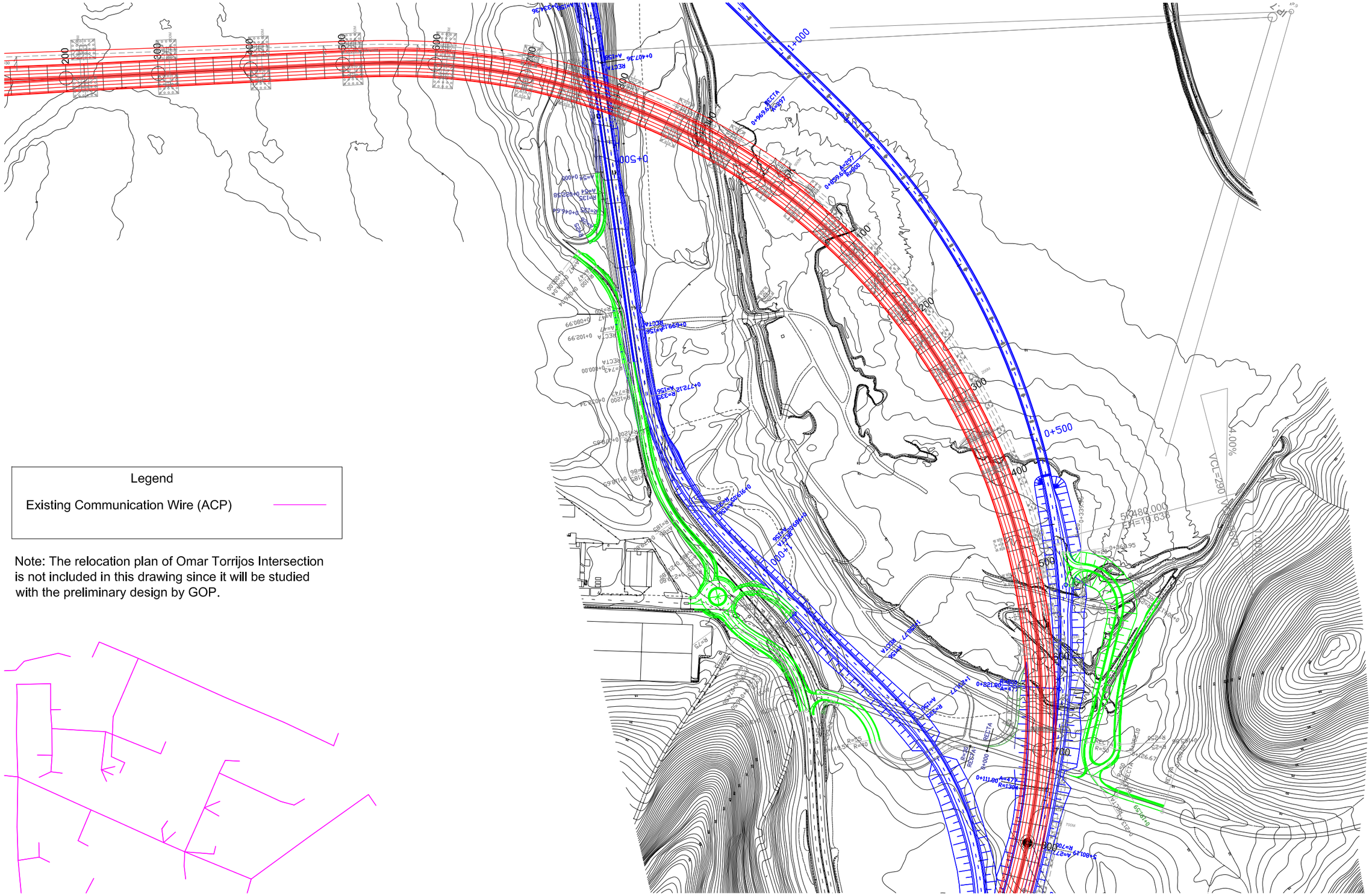
Location of Existing Utilities and Relocation Plan (Communication wire) (4 of 5)



Legend

Existing Communication Wire (ACP)

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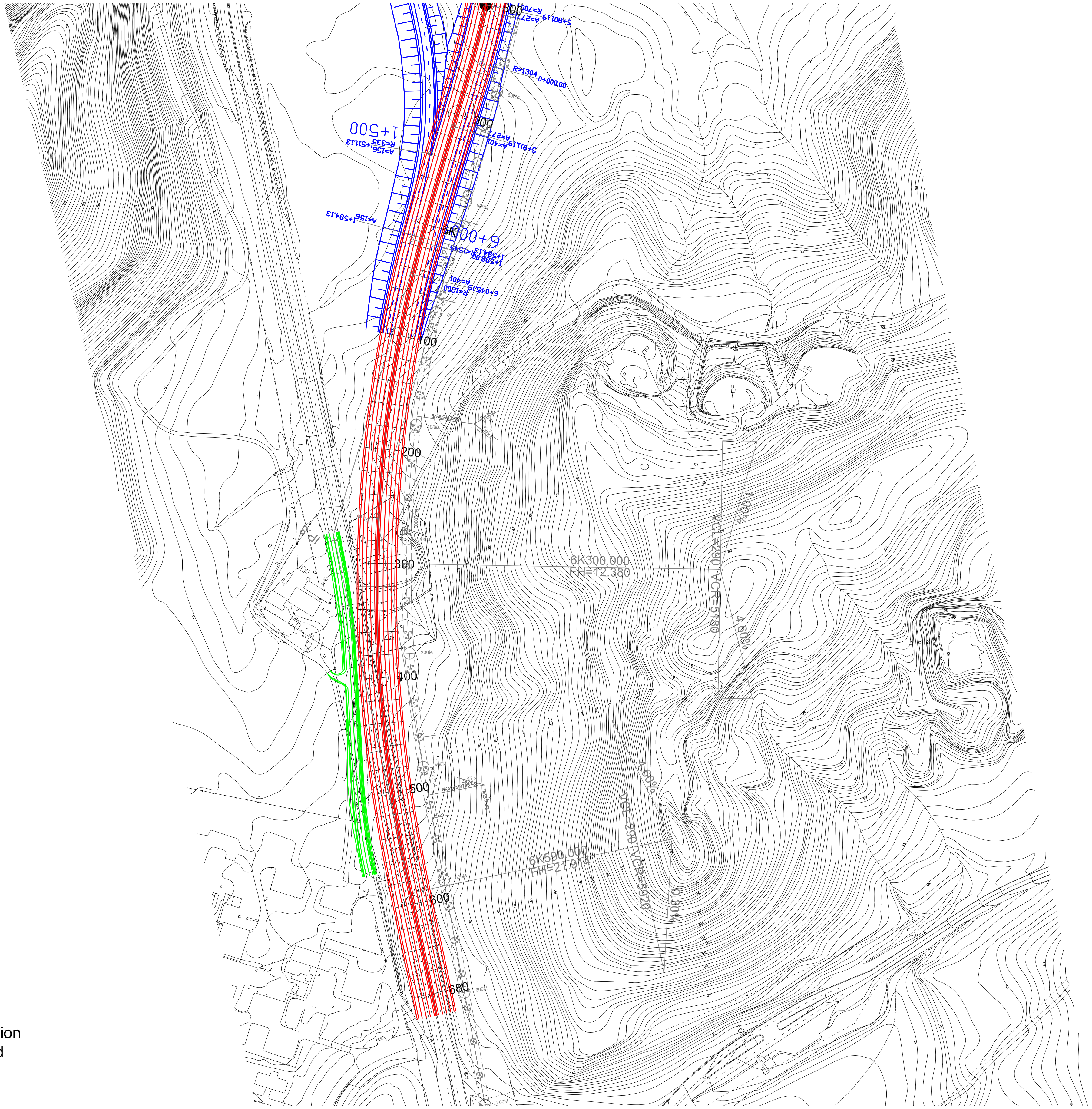
Location of Existing Utilities and Relocation Plan (Communication wire) (4 of 5)

Location of Existing Utilities and Relocation Plan (Communication wire)   (5 of 5)



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付属資料 7: 概算工事費積算内訳表
(第 4 パナマ運河橋)

請負業者選定までは非公開とする。

付属資料 8: 概算運営維持管理費内訳表
(概略設計対象)
(第 4 パナマ運河橋)

請負業者選定までは非公開とする。

付属資料 9: Pre-F/S レビュー・レポート(斜張橋)

請負業者選定までは非公開とする。

付属資料 10: リスク分析レポート
(第 4 パナマ運河橋主橋)

Results of Risk Analysis

due to Closure of Pacific Approach Channel

for Erecting the Rib Arch Segment of the 4th Bridge over the Panama Canal

1. BACKGROUND:

The Secretaría del Metro de Panamá (SMP) is conducting a feasibility study for the construction of the 4th Bridge over the Panama Canal with technical assistance from a Japanese Survey Team financed by the Japan International Cooperation Agency (JICA).

The feasibility study for the 4th Bridge over the Panama Canal includes a section on the evaluation of alternative bridge types. Among the different bridge types evaluated, the Cable-stayed (refer to Figure #1) and Steel Arch (refer to Figure #2) stood out based on a multi-criteria analysis. One element which differentiates between these two bridge types is the level of interference with Panama Canal operations. If no interference with Canal operations is assumed, the Cable-stayed type bridge ranks above the Steel Arch type in the multi-criteria evaluation, based on lower cost, construction period and risk. Under this same prerequisite, the Steel Arch Bridge requires significant temporary works for assembling the arch which results in higher cost and longer construction period. The Steel Arch Bridge does offer some advantages over other bridge types by providing a more rigid structure and distinctive architectural features.

The JICA Survey Team conducting the feasibility study has proposed an alternative construction method for the Steel Arch Bridge that requires closure of the Pacific Approach navigational channel for a short period in order to erect the central rib arch segment of the bridge structure that would be prefabricated simultaneously with the rest of the on-site bridge structure. This construction method would eliminate the need for mayor temporary works reducing construction of the Steel Arch Bridge by 10 to 12 months and its cost. Under this premise, one element that needs to be evaluated and quantified is the impact of the Pacific Approach Channel closure upon the Panama Canal, the local ports and other primary elements of the container logistic system which might be impacted when the rib arch is assembled around year 2019.

The proposed erection method of the large rib arch segment of the bridge has no precedence. Consequently, the SMP in conjunction with the Autoridad del Canal de Panamá (ACP) conducted a risk analysis of the proposed Pacific Approach channel closure to identify associated risks, define mitigation measures & contingency plans and quantify the economic impact of such risks. The result of this risk analysis will be included as part of the feasibility study for the 4th Bridge over the Panama Canal.

Figure # 1 Cable-Stayed Bridge Type

Figure # 2 Steel Arch Bridge Type

2. IDENTIFICATION AND QUANTIFICATION OF RISKS:

The risk analysis performed by SMP and ACP involved several workshops, some in which members of the JICA Survey Team participated. From these workshops and other meetings with ACP personnel from operations, engineering and risk management, the different risks were identified. This process concluded with the identification of three (3) significant risks.

Risk #1: Closure of Pacific Approach Channel during the Erection of Rib Arch Segment:

To determine the probability and impact of the rib arch segment erection, the JICA Survey Team provided the list of work activities directly associated with the erection process which requires the closure of the Pacific Approach navigational channel. The SMP together with the ACP evaluated these work activities and established minimum and maximum times for the rib arch erection process, which resulted in a time range of navigational channel closure. The erection work activities and times are the following:

Step Number	Work Item	Min. Time	Maxi. Time
Step 1	Towing by tugboats	0.5 Hours	1.0 Hour
Step 2	Anchoring	1.0 Hour	2.0 Hours
Step 3	Setting of Hooks for Lifting	2.0 Hours	4.0 Hours
Step 4 ** Note 1*	Lifting Up of Arch Rib Segment	8.0 Hours	12.0 Hours
Step 5	**Temporary Fixing of Arch Rib Segment**	**1.0 Hour**	**3.0 Hours**
Step 6	Final Inspection	1.0 Hour	2.0 Hour
Channel Using Time Total		13.5 Hours	24.0 Hours

For the risk analysis of channel closure for erecting the rib arch segment, the maximum time was used for quantifying the impact of erecting the rib arch segment.

The scenario for the risk analysis corresponds to the year 2019 when the rib arch segment will be erected. In that year, the post-panamax locks (Third Set of Locks) will be fully operational and as would be ACP´s port of Corozal on the east bank of Balboa Reach. Traffic of post-panamax vessels is expected at 8 vessels per day and container movements at the three Pacific ports is projected at close to 20,000 TEU per day.

The 24-hour closure of the Pacific Approach channel of the Panama Canal would result in one full day of delayed transits, generating a queue (backlog) of between 20 to 30 transits above normal levels, of which 8 queued transits would be post-panamax. Also, loss of revenue from the Transit Reservation System would accrue to one full day. Such a relative small backlog will not result in any lost transits. However, in order to reduce the backlog of waiting vessels to normal levels, the ACP must operate at a level of capacity beyond normal for a period averaging 5 days. To achieve

this additional capacity on a daily basis, more pilot assignments are required, as are additional crews at the locks and extra towboat assignments and overtime. To mitigate the one-day impact of delayed transits, before the channel closure takes effect, between 3 to 4 transiting vessels could be anchored within Balboa Reach and Pacific Basin area. Also, to mitigate adverse effects from unfavorable meteorological phenomena, the ACP recommends to program the rib arch segment erection between the months of June and August.

To quantify the effects on port operations by the channel closure, a cursory evaluation was made to determine potential economic impact. The timing and day of the week selected for the rib arch segment erection could have considerable impact on the Pacific ports and the Panama Canal Railway; therefore, the day of the week selected for the erection operation is important. Since at this point such micro planning is not possible, for the analysis of ports and railway an average condition was considered. Most of the containership berthing at the Pacific ports are from Northbound (navigating from the Pacific coast to the Atlantic coast) transits moving through the Panama Canal, these ports would be impacted by the Pacific Approach channel closure. Berthing delays due to channel closure should result in idle berth space and resources, and a backlog of containers at the port yards resulting in double handling of some of these containers. No loss of revenue for the ports is expected. However, to normalize port operations, increased cost from overtime and additional container handling will be required. When taking into account mitigation measures for reducing impact to Pacific port operations, it is estimated that during the 24-hour channel closure, 75 percent of Pacific ports container movements will be delayed, or approximately 15,000 movements in a 24-hour span. The economic impact analysis for the ports does not consider penalties for late cargo delivery.

Most berths at the Atlantic ports are generated from Southbound transits through the Panama Canal with small portion from Northbound transits. An important portion of container movements in the Atlantic ports represent the repositioning of empty units. The effect on the Atlantic ports will be negligible (at less than 10 percent of container movements) since container vessel arriving from the Atlantic Ocean to the Atlantic ports are not impacted by the Pacific Approach channel closure.

Container transshipment movement using the Panama Canal Railway Company (PCRC) is expected at 18,000 containers per week for 2019. But considering that the Pacific ports container yards can stack more containers than the railroad can move in a single day, the PCRC operation would not be affected.

Direct economic compensation to affected key stakeholders is anticipated for the 24-hour channel closure. This economic compensation is summarized below and represents a rough approximation in order to establish cost values to include in the cost estimate of the Arch Bridge construction.

Impact	Stakeholder affected	Amount of Compensation
Loss of revenue from Transit Reservation System	ACP	US$731,022.00

Incremental transit capacity for 5 days to reduce backlog:	ACP	
- Pilot assignments	ACP	US$325,000.00
- Towboats	ACP	US$24,320.00
- Lock crews	ACP	US$55,000.00
- Contingency (10% of above)	ACP	US$40,750.00
Loss of Pacific Port berths	Pacific ports	US$650,000.00
Loss of Atlantic Port berths	Atlantic ports	US$65,000.00
Loss of container transshipment movements for PCRC	PCRC	US$0.00
Total Direct Compensation		US$1,891,092.00

Channel closure for erecting the rib arch segment will require contingency plans and special preventive measures, in addition to the equipment and resources required for executing the rib arch segment erection process that has been recommended by the JICA Survey Team. The additional resources and/or plans required for the erection of the rib arch segment are summarized as follows:

a. At least two standby generators to power the strand-jacks, one on each side of the main bridge support sections

b. Two spare (emergency) hydraulic jacks one on each side of the main bridge support sections in case of a hydraulic jack failure

c. Rental of the ACP´s floating crane Titan for a minimum period of 40 hours at a cost of US$110,000.00, for each erection plan occurrence.

d. At least two standby generators one for each of the two floating barges supporting the rib arch Segment to operate anchor mechanisms in case of failure of the on-board electrical power

e. At least two standby towboats in addition to those required to position the floating barges supporting the rib arch segment

f. All the equipment and resources required for floating and swinging out of the channel of the rib arch segment, within a period of 72 hours, if it happens to fall into the navigational channel (refer to Risk #3). This includes the use of ACP floating cranes plus additional back-up cranes and sufficient human resources to accomplish the rescue mission in case of an emergency. All cables used in the lifting and rescue operation shall have sufficient strength and an adequate safety factor in case of movements beyond those normally expected. The lifting operation must be halted if any malfunction occurs.

g. The temporary method of fixing the rib arch segment to the permanent structural elements on both sides of the bridge, upon lifting the rib arch, needs to be evaluated in more detail and redundancy methods need to be identified and incorporated to mitigate all risks associated with fixing of the rib arch segment to the rest of the bridge structure.

h. Given the significant and negative impact that failing to erect the rib arch segment properly would have on the operations of the Panama Canal, the Pacific ports and the Panama Canal Railway, especially if the rib arch segment falls into the navigational channel, it would be prudent to conduct one or more simulated lifts at the factory site where the rib arch segment is fabricated prior to its deployment to Panama. The test lift of the rib arch segment should be performed high enough and under similar conditions to permit the evaluation of all elements, procedures and equipment that will be involved in the erection process. Such test lift; however, could be performed on land and not necessarily over water. All costs associated with the test lift should be charged to the Arch Bridge project and included in its cost estimate.

i. All critical activities involving the lift of the Arch Bridge shall be scheduled during daylight hours and under favorable meteorological conditions during the months of June and August.

All associated cost and resources required for complying with contingency plans and measures listed in this document must be included in the construction cost of the Arch Bridge.

Risk #2: Short notice postponement of Pacific Approach Channel closure date:

This risk contemplates the possible postponement of the original scheduled date for the Pacific Approach channel closure for rib arch segment erection. The probability assigned to the risk of postponing the original scheduled date for the channel closure is considered moderate (at 50 percent) due to the many contingency plans and special requirements that must be in place before initiating the channel closure for erecting the rib arch segment.

This risk contemplates a change in the scheduled date within short notice of less than 12 hours. Because of the short notice, the ACP cannot offset the original impact of the closure of the channel; therefore, roughly 50 to 75 percent of the transits that could have navigated the Panama Canal on a normal day would be delayed causing an abnormal but small backlog in the neighborhood of 15 to 20 vessels. The ACP must reduce this backlog to normal levels before rescheduling the Pacific Approach Channel closure for erecting the rib arch segment. Consequently, the revenue of the Transit Reservation System from the original scheduled date will be loss plus that of the postponed closure. The incremental Canal capacity needed to reduce the resulting backlog with all its associated costs would be required for a period of 3 days. Some minor impact to Pacific and Atlantic ports, as well as for the PCRC may materialize if they are not able to reschedule ship berthing. However, the economic impact to ports and railroad was not considered for this risk.

Impact	Stakeholder affected	Amount of Compensation
Loss of revenue from Transit Reservation System	ACP	US$548,266.50
Incremental transit capacity for 3 days to reduce backlog:		

- Pilot assignments	ACP	US$195,000.00
- Lock crews	ACP	US$14,592.00
- Towboat	ACP	US$33,000.00
- Contingency (10% of above)	ACP	US$24,450.00
Loss of Pacific port berths	Pacific ports	n/a
Loss of Atlantic port berths	Atlantic ports	n/a
Loss of container transshipment movements for PCRC	PCRC	n/a
Total Direct Compensation		**US$815,308.50**

The economic consequence of this risk must be considered as part of the direct compensation package to the ACP by the contractor building the Arch Bridge.

Risk #3: Rib Arch Segment falling into the Pacific Approach channel causing an extended closure beyond the 24-hour period:

This risk considers the possibility that the rib arch segment being erected for the Arch Bridge fails and the rib arch structure falls into the Pacific Approach navigational channel blocking the transit of vessels in and out of the Panama Canal and the Pacific ports. Because of the many technical and safety requirements for the erection and fastening of the rib arch segment and the contingency plans contemplated to mitigate the impact of this risk, the likelihood of this risk materializing is considered low (below 10% probability); however, its impact on the Panama Canal, Pacific and Atlantic ports operations is considerable.

To quantify the impact of such risk, a preliminary analysis was conducted using the ACP´s computer simulation model for Canal Operations. ACP executed computer simulation runs for a 3-day closure, which indicated that the backlog of vessels awaiting to transit the Panama Canal would increase to levels between 80 to 95 vessels. Above the 100-vessel backlog with a heavy mix of post-Panamax vessels, it is possible for traffic diversion to take place, causing loss of transit revenue to the ACP. At this backlog level, it would take the ACP several weeks, working at full capacity with the post-panamax locks, to recover the queue of waiting vessels to normal levels. Any backlog that exceeds 100 vessels is considered unacceptable to the Panama Canal. Under high vessel traffic, a 3-day closure of the Panama Canal would produce backlogs nearing the threshold level of 100 waiting vessels. Consequently, the maximum period of channel closure shall not exceed 3 days.

Under the scenario of a maximum closure of 3 days, the JICA Survey Team presented a contingency plan to float and swing out-of-the-way the rib arch segment to open the navigational channel in a time period bellow 72 hours. The total buoyancy required to partially float the rib arch segment is estimated at 2,535 tons. The contingency plan proposed by the JICA Survey Team involves the use of buoyancy bags with floating capacity of 35 tons each. Therefore, for partially lifting the rib arch segment a total of 75 lift bags will be required. These air bags must be attached

underwater to the rib arch structure employing around 20 industrial divers. The process of attaching and inflating 75 lift bags is possible but impractical. In all, a total of 6 air compressors will be required to fill the floating bags. These air compressors must be outfitted on top of floating barges with portable generators. Also, at least 4 tow or pusher boats with on-board cranes will be required to move the barges with the air compressors and to attach the floating bags. Powerful towboats will be required for swinging out the rib arch segment to open the navigational channel for vessel traffic. In conclusion, the solution presented by the JICA Survey Team needs to be refined to develop a contingency plan that is more practical to execute and has higher potential for success within the 72-hour envelop available to retrieve the fallen rib arch segment.

All the equipment and resources required to execute the proposed contingency plan need to be estimated and costed, and added to the cost estimate of the project. In case of a fallen rib arch segment, the cost of remanufacturing the fallen arch structure plus the incurred delays must be quantified and added to the estimate of the project cost by way of a special purpose insurance policy.

The cost to principal stakeholder as a consequence of a 3-day channel closure involve the following:

a. Loss revenue from 3 days of the ACP´s Transit Reservation System.

b. Increased transit capacity of the Canal for a period of 19 days after the navigational channel is cleared and opened to reduce the accumulated backlog of transiting vessels. No loss in transit revenue was considered; although, if closure exceeds 3 days, loss of transit revenue is possible.

c. Mobilization and demobilization of salvage equipment in the region and daily operating cost of such equipment.

d. Increased cost due to idle (unproductive) berths and resources, additional port crews and overtime to load/unload backlog of berthing vessels accumulated due to channel closure, and the need for double handling of some container movements accumulated (transshipment) because of idle berthing space at the Pacific ports at 75% of daily container volume on the first day (similar to 24-hour closure) and 100% of container volumes for second and third days of closure.

e. Idle berth space at the Atlantic ports due to Northbound vessel delayed by channel closure in Pacific side and additional cost of overtime to handle containers delayed by closure of Pacific ports (that will be working overtime to makeup delays) at 10% of Pacific ports on first day and 25% on days two and three.

f. Cost of negotiated contract clauses with shippers on late delivery of cargo that is applicable to all ports is not considered, since it is assumed that berthing vessels trapped in the Canal´s transit backlog would be moved to Atlantic ports for berthing as soon as a slot is available and then returned to the Atlantic anchorage to await transit through the Panama Canal. The cost associated with these additional vessel movements is considered for the vessels delayed for as

many as 18 vessels (2 berths for 3 days of channel closure for the 3 Atlantic ports). The estimated cost of the 18 additional vessel movements to and from anchorages includes extra pilot assignments, channel fees, launches and towboats.

g. PCRC could mitigate impact by transferring empty containers and performing maintenance on railway track.

The above cost are summarized in the following table:

Impact	Stakeholder affected	Amount of Compensation
Loss of revenue from Transit Reservation System for 3 days	ACP	US$2,193,066.00
Incremental transit capacity for 19 days to reduce backlog:		
- Pilot assignments	ACP	US$1,235,000.00
- Lock crews	ACP	US$92,416.00
- Towboat	ACP	US$405,654.18
- Contingency (10% of above)	ACP	US$173,307.02
Mobilization and demobilization of salvage equipment	Subcontractors	US$750,000.00
Operation of salvage equipment	Subcontractors	US$300,000.00
Loss of Pacific port berths	Pacific ports	US$2,350,000.00
Loss of Atlantic port berths	Atlantic ports	US$500,000.00
Extra vessel movements in Atlantic from anchorage to ports and back	Pacific ports	US$88,000.00
Loss of container transshipment movements for PCRC	PCRC	n/a
Replacement of rib arch segment	Contractor	To be estimated by JICA Survey Team
Construction delays of 4th Bridge and star-up of Line 3 of the Metro	Government of Panama	To be estimated by JICA Survey Team
Total value of Compensation		**US$8,087,443.20**

Because the probability of the rib arch segment falling into the Pacific Approach channel is low, it is recommended that the economic compensation from such risk be covered by a special purpose insurance policy with the principal stakeholders (APC, Pacific and Atlantic ports) as beneficiaries. Additionally, since this insurance is unique in the sense that it is directly related to the construction methodology chosen for the Arch Bridge that requires the use of the navigational channel, it must also cover the cost of fabricating a new rib arch segment and the economic impact of delaying the execution of the 4th Bridge Project and postponement of the start of operations of Metro Line 3.

The cost of this special purpose insurance policy to cover the economic compensation to principal stakeholders and the cost of building a new rib arch segment and related implementation delay

costs could be in the neighborhood of 10 to 15% of the total insurance coverage. The cost of the insurance policy is a direct cost to the project. Additionally, the cost of the project shall borne the minimum deductible that must be covered by the contractor multiplied by the probability of occurrence of this risk. Giving that this is a unique risk, the cost of collateral, which may be demanded by the insurance company and/or its underwriters, should be quantified.

3. CONCLUSIONS:

The risk analysis conducted by the SMP and ACP to assess the impacts of channel closure for the erection of the rib arch segment of the 4th bridge over the Panama Canal identified and evaluated the following risks:

Risk	Event	Risk cause	Consequence	Probability	Impact	Recommended Mitigation
1	Erection of rib arch segment	24-hour closure of Pacific Approach Channel	Backlog of around 20 to 30 vessels and some berth losses at Pacific and Atlantic ports and backlog of container transshipment movements	100%	Low	- Redundancy of rib arch lifting and fixing method - Lifting of rib arch should take place between June and August when meteorological conditions are most favorable - Qualified personnel to execute the erection of the rib arch - Robust contracting clauses and requirements that the contractor must comply with - Simulation test of erection method at rib arch fabrication site - Contingency plan for a 72-hour removal of the fallen rib arch segment from channel - Full economic compensation to ACP, Pacific and Atlantic ports
2	Postponement of erection of rib arch segment	Reprogramming of 24-hour channel closure within short notice	Transit capacity for original closure not fully recovered, causing a low backlog and minor berth losses a Pacific and Atlantic ports	50%	Low	- Coordination of closure with sufficient lead-time between ACP, SMP, Contractor, port operators and railway operator - Full economic compensation to ACP, Pacific and Atlantic ports
3	Fall of rib arch segment into channel	Closure of navigational channel beyond 24-hours but not exceeding 72 hours	Major backlog of transiting vessels and losses for several days of berths at Pacific and Atlantic ports and container transshipment movements	10%	High	- All contractors risk insurance, civil responsibility and loss of revenue (refer to details in ACP Risk Evaluation) - Performance and payment bonds

						- Bank guarantees to insure payment of direct economic compensations - Robust contracting clauses and requirements that the contractor must comply with - Have in place a contingency plan with capability for retrieving the rib arch segment within a period of less than 72-hour - Redundancy systems and equipment available (standby) in case of mechanical and electrical failures that would delay the lifting and installation of the rib arch - Improve fallen rib arch segment retrieval method to add redundancy for critical tasks - Insurance must also cover cost of replacing the rib arch segment and the economic impact on project implementation and delay on startup of Metro Line 3

- A critical component of the proposed rib arch segment erection method are the contingency plans required to add redundancy to the erection processes and to generate the capability for retrieving the fallen rib arch segment from the navigational channel within the threshold of 3 days to resume normal navigation.
- Since the lift of the rib arch segment has no precedence, it is highly recommended to perform simulation tests of the erection plan at the rib arch fabrication site before transporting the rib arch to Panama.
- Means of economic compensation to ACP and Pacific and Atlantic ports are recommended in this risk analysis to cover cost incurred directly due to erection of rib arch segment closing the Pacific Approach navigational channel. Also, the insurance cost for replacing a damaged rib arch segment and for compensating delays caused by any accident must be quantified and included for the 4th Bridge Project and the startup of Line 3 of the Metro. These impacts must be included in the cost estimate of the 4th Bridge Project.
- The SMP must coordinate with ACP during the elaboration of terms and conditions of the solicitation documents for the 4th Bridge to insure clear establishment of the economic compensations to mayor affected stakeholders and the mechanisms to ensure payment to the ACP and ports.

- Finally, all cost associated with the rib arch bridge construction methodology, including associated costs, contingency plans and resources to execute the contingency plans listed in this document must be included in the cost estimate of the Arch Bridge over the Panama Canal. Also attributed and derived cost such as direct economic compensation, insurance policies and loss of revenue to affected stakeholders, plus the replacement of the rib arch and delays to 4th Bridge Project and Line 3 of the Metro must be accounted for.

付属資料 11:環境社会配慮

付属資料 11-1 フォーカス・グループ・ディスカッションの結果要約

(1) Focus Group Discussion with Women User of Public Transportation

[Women User of Public Transportation] February 17, 2014 16:00~17:30 Location: Specialized University of Las Americas Seven participants (Invited participants in the Albrook Bus Terminal)	 Source: URS Holdings, Inc.

Main opinions

- All participants agreed to the installation of the Metro Line 3. At the same time, they suggested that the route should reach until La Chorrera.
- They expressed a great dissatisfaction with the current transport system, buses and taxis, especially because of bad travel conditions (problem with safety, no seat, no air conditioning, long travel time, bad driving manner, etc.).
- They also pointed out that the *piratas*, “alternative transportation”, is important transportation which has more frequent services, with good conditions, and with short travel times. The problem is taht they do not have insurance to cover passengers, and the fee is quite high.
- They have willingness to pay from USD 0.25 (normal bus rate) to USD 1.50 (*piratas*, illegal bus rate) if the travel time is reduced and a good quality service is provided. For example, a lady who gains US$20 per day pays US$8 for transportation.
- They indicated that it is necessary of public education to build a culture oriented to care for these public goods.

(2) Focus Group Discussion with University Students

[University Students] February 18, 2014 14:30~16:10 Location: Specialized University of Las Americas Eight participants plus 15 observers (Selected by drawing)	 Source: URS Holdings, Inc

Main opinions

- The participants expected that the Metro Line 3 will be an efficient and well organized transportation system.
- They are worried about the disorder of the exiting transportation system.
- They emphasized the importance of educating school students to keeping the system in good condition.
- They insisted that it is very important to educate/guidance on how to use Metro.

(3) Focus Group Discussion with Community Leaders and Workers in Burunga, Arraijan

[Community leaders and workers in Burunga, Arraijan] February 20, 2014 17:00~18:30 Location: El Diamante, Burunga 10 participants	 Source: URS Holdings, Inc.

Main opinions

- Burunga workers consider that the Metro will be a viable alternative transportation that can help to improve transport in the area. For example, it takes around only 15 minutes without traffic jam, but it takes 1 hour to 1.5 hour with traffic from Albrook to Burunga.
- They are aware of their responsibility in the invasion of RoW.

(4) Summary of Focus Group Discussion with Transportation Sector

[Transportation Sector] March 17, 2014 10:00~11:30 Location: Panama International Maritime University (La Boca) Six participants (Four taxi drivers, one administrator of Bus Association, one *pirata*, *"alternative transportation"*, driver)	 Source: JICA Study Team

Main opinions

- The participants have strong perception for transportation system, because it is they who have been providing services for a long time.
- They agreed with the Metro Line 3 Project, but at the same time, they do not want to leave the current transportation system.
- They strongly recommended improving the internal routes in Arraijan. It is required to pave existing small roads.
- They emphasized the necessity to integrate all transportation sectors.

Source: Elaborated by the JICA Study Team based on URS Holdings, Inc. (2014)

付属資料 11-2 ルート選定代替案比較 - 環境社会配慮の側面より

Ref	Issue	Autopista Route		Panamericana Route	
		Advantages	***Disadvantages***	***Advantages***	***Disadvantages***
1	Land acquisition and resettlement	• Resettlement unlikely			• Resettlement is quite likely, particularly for associated infrastructure • Compensation for lost business premises etc is likely to be high
2	Local economy, employment and livelihoods	• Business generation is likely to occur around stations and other infrastructure • May better serve future needs?	• Will not serve the existing community as well, and fewer passengers are likely if this route is selected (initially)	• Will better serve the existing community, and more passengers are likely if this route is selected • Business generation is likely to occur around stations and other infrastructure • Existing businesses are likely to benefit • The service will be most beneficial to existing settlements in the project area	• Construction process may adversely affect local businesses • Some businesses may be permanently affected by the project
3	Land use and local resources usage	• More space is available for working areas • Greater opportunity for land use planning • This route option could allow for advanced integrated town planning, though it is unlikely	• The number of new feeder roads required, as well as the establishment of stations in relatively uninhabited areas means that significant development at these sites is to be expected	• Less space is available for working areas • Less opportunity for land use planning	• Possible perception that the project is serving current needs without considering future land development
4	Social capital and Local organizations	• Unknown	• Unknown	• Unknown	• Unknown
5	Existing infrastructure and public services	• Likely to be few conflicts with existing services such as water and electricity supply	• Possibilities for new services/systems could be seen as an advantageous opportunity	• Existing infrastructure and services is already in place and could potentially be adapted as needed	• Likely to be many conflicts with existing services such as water and electricity supply
6	Ethnic minorities and indigenous community	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
7	Unbalanced distribution of benefits and damages	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
8	Local conflicts caused by common interests	• Unknown	• Unknown	• Unknown	• Unknown
9	Cultural heritage	• Unknown	• Unknown	• Unknown	• Unknown
10	Right of water use	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
11	Infectious diseases such as HIV/AIDS	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
12	Safety		• Likely to be high risk of workers accident	• Unlikely to be much difference	• Likely to be high risk of accidents involving the public
13	Topography and geography	• Likely to be less civil works.			• The volume of civil works for construction of stations is likely to be bigger.
14	Underground water	• Unknown	• Unknown	• Unknown	• Unknown
15	Soil erosion		• Soil erosion is likely to be increased	• Soil erosion is likely to be less	
16	Hydrology	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
17	Flora, fauna and biodiversity		• Risk of adverse impacts is slightly higher	• Possibility of redeveloping brownfield land for depots etc could reduce impacts	
18	Landscape	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
19	Protected Natural Areas (PNAs)	• No PAs near route	• No PAs near route	• No PAs near route	• No PAs near route
20	Global warming	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
21	Air pollution	• Construction related air quality impacts are likely to be less significant due to lack of sensitive receptors	• Operational air quality impacts are likely to be more significant due to the expected increased need of feeder buses	• Operational air quality impacts are likely to be less significant	• Construction related air quality impacts are likely to be more significant due to sensitive receptors
22	Water pollution	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
23	Soil pollution	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
24	Waste management	• Waste management during both construction and operation is likely to be easier to manage and control	• New collection routes will be required during operation	• Existing collection routes can be modified (if they exist)	
25	Noise and vibration	• Both construction and operational noise and vibration impacts are likely to be lower			• Both construction and operational noise and vibration impacts are likely to be higher
26	Land subsidence	• Unknown	• Unknown	• Unknown	• Unknown
27	Offensive odors	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference	• Unlikely to be much difference
28	Traffic	• Disruption during construction likely to be less significant • Accidents likely to be fewer	• Any accidents could be more serious	• Any accidents likely to be less serious	• Disruption during construction likely to be more significant • More accidents likely

Source: JICA Study Team

付属資料 11-3 システム代替案比較 - 環境社会配慮の側面より

Ref	System	Advantages	Disadvantages
1	Automated Guideway Transit (AGT)	• Running performance for hill-climbing and small curvature, Low noise and vibration	• Electric consumption is larger than the system which is using steel wheel. • Basically, slab structure which gives large impact to the landscape is installed
2	Monorail	• Ditto • Generally, transport capacity is larger than that of AGT. • Since no slab structure is installed, impact to the city landscape is low.	• Electric consumption is larger than the system which is using steel wheel.
3	Linear metro	• Hill-climbing performance, and lower noise from steel wheel than MRT. • R.O.W is smaller than that of MRT.	• Basically, slab structure which gives large impact to the landscape is installed
4	Urban Railway / MRT	• Large transport capacity, Large number of manufacturer in the world. • Low electric consumption per transport capacity	• Basically, slab structure which gives large impact to the landscape is installed • Bigger noise and vibration compared with other system. • Flexibility of an alignment is lower than that of other system. And this system can't adapt to small curvature and steep gradient. It may cause land acquisitions.
5	LRT (Tramway with segregated RoW)	• Low construction cost when it is constructed at grade.	• Since R.O.W is installed in road space, this system gives large impact to road traffic.

Ref	System	Construction									Operation	
		Needs tunnel?	*Construction period below, at or above average?*	*Nature of line – raised or ground level?*	*Civil works requirement below, at or above average?*	*Overhead line?*	*Number of required substations*	*Difference in working area required during construction?*	*Earthworks requirement below, at or above average?*	*Piling / dewatering requirement below, at or above average?*	*Safety*	*Noise/ vibration*
1	Automated Guideway Transit (AGT)	No Applicable maximum gradient is 6%	Average	Raised	Average	Side	Various kind of voltage	Average	Average	Average	Secured by ATP (Automatic train protection)	Lower Because of rubber tire
2	Monorail	No Ditto	Below	Raised	Below	Side	DC1500V or DC750V	Smaller	Below	Below No slab structure	Secured by ATP (Automatic train protection)	Lower Because of rubber tire
3	Linear metro	No Ditto	Average MRT + Reaction plate installation	Raised or Ground level	Average	Overhead	DC1500V	Average	Average	Average	Secured by ATP (Automatic train protection)	Lower Because of bogie with steering system
4	Urban Railway / MRT	Yes Applicable maximum gradient is 3.5%	Above	Raised or Ground level	Above	Overhead	Various kind of voltage	Larger Because of large structure	Above	Above Axle load of train and dead load of structure are heavy	Secured by ATP (Automatic train protection)	Average
5	LRT (Tramway with segregated RoW)	Yes Ditto	Below Because of at grade	Ground level	Below Because of at grade	Overhead	Various kind of voltage	Larger Because of ground level	Below Because of at grade	Below Because of at grade	Secured by driver	Lower Because of steel wheel of sandwich structure with rubber
	The System of Metro Line 1, elevated section		**Average**		**Average**			**Average**	**Average**	**Average**		**Average**

Note:
Regarding Construction period, Civil works requirement, Difference in working area, Earthworks requirement and Piling dewatering requirement, the system of Metro Line 1 was considered to be an "Average" and each system was compared.
AGT, Linear metro, MRT and HSST have slab structure in superstructure. In this table, adoption of U-shape slab structure which is used in Line-1 was assumed.
LRT can be installed as a Raised line. However, LRT in this table is assumed as at grade.
Number of required substations is depending on voltage of the system. Since some systems are adopting various kind of voltage, please ask this question to an electric specialist.
Source: JICA Study Team

付属資料 11-4 ベースライン調査次に確認された陸上植物種

Family	Scientific Name	Vernacular Name	IUCN Red List	Panamanian Law (Resolution AG-0051)
Acanthaceae	*Aphelandra scabra*	-	-	VU
Adiantaceae	*Adiantun lunulatum*	Walking Maidenhair Fern	-	-
Anacardiaceae	*Anacardium excelsum*	Wild Cashew	-	-
	Anacardium occidentale	Cashew	-	-
	Astronium graveolens	Glassywood	-	VU
	Spondias mombin	Hog Plum	-	-
Annonanceae	*Annona purpurea*	Soncoya	-	-
	Xylopia frutescens	-	-	-
	Guatteria sp.	-	-	-
	Porcelia magnifructa	-	-	-
Apocynaceae	*Thevetia peruviana*	Yellow Oleander	-	-
Araceae	*Dieffenbachia sp.*	-	-	-
	Rodospatha sp.	-	-	-
	Philodendron sp.	-	-	-
	Monstera sp.	-	-	-
Araliaceae	*Schefflera morototoni*	Morototo	-	-
	Dendropanax arboreus	-	-	-
Arecaceae	*Attalea butyracea*	Yagua Palm	-	-
	Bactris cf.coloniata	Uvito Palm	VU	VU
	Desmoncus orthacanthos	-	-	-
	Elaeis oleifera	American Oil Palm	-	-
	Oenocarpus mapora	Don Pedrito's Palm	-	-
	Roystonea regia	Cuban Royal Palm	-	-
	Chryosophila warscewiczii	-	-	-
	Cryosophila warscewiczii	-	-	-
Asteraceae	*Delilia biflora*	-	-	-
	Mikania sp.	-	-	-
	Vernonanthura patens	Salvión	-	-
Bignoniaceae	*Arrabidaea sp.*	-	-	-
	Tecoma stans	Yellow Trumpetbush	-	-
	Tabebuia guayacan	Guayacan Trumpet Tree	-	VU
	Tabebuia rosea		-	VU
Bombacaceae	*Ochroma pyramidale*	Balsa	-	-
	Pseudobombax septenatum	-	-	-
Boraginaceae	*Cordia alliodora*	Spanish Elm	-	-
	Cordia panamensis	Guacalmanono	-	-
Bromeliaceae	*Bromelia pinguin*	Penguin	-	-
Burseraceae	*Bursera simarouba*	Copperwood	-	-
	Protium panamense	Jennywood	NT	-
Cactaceae	*Epiphyllum phyllanthus*	-	LC	VU
Capparaceae	*Capparis cf. frondosa*	-	-	-
	Cleome sp.	-	-	-
Caricaceae	*Vasconcellea cauliflora*	Carica	-	-
Cecropiaceae	*Cecropia sp.*	-	-	-
	Cecropia peltata	-	-	-
Chrysobalanaceae	*Hirtella americana*	Pigeon Plum	-	-
	Hirtella racemosa	-	-	-
Clusiaceae	*Vismia billbergiana*	Sangrillo	-	-
Cochlospermaceae	*Cochlospermum vitifolium*	-	-	-
Combretaceae	*Laguncularia racemosa*	White Mangrove	LC	EN

Family	Scientific Name	Vernacular Name	IUCN Red List	Panamanian Law (Resolution AG-0051)
	Terminalia oblonga	-	-	VU
	Terminalia amazonia	-	-	VU
Convolvulaceae	*Ipomoea sp.*	-	-	-
Costaceae	*Costus villosissimus*	Porcupine Ginger	-	-
Cyatheaceae	*Cyathea petiolata*	-	-	VU
Cychlanthaceae	*Carludovica palmata*	Panama Hat Plant	-	-
Cucurbitaceae	*Gurania makoyana*	-	-	-
Dilleniaceae	*Curatella americana*	Sandpaper tree	-	-
Euphorbiaceae	*Acalypha diversifolia*	-	-	-
	Acalypha macrostachya	-	-	-
	Croton schiedeanus	Coegalasapi	-	-
	Sapium glandulosum	Gumtree	-	-
Fabaceae-Caesalpinioideae	*Andira inermis*	Cabbage bark tree	-	-
	Cassia sp.	Cassia	-	-
	Copaifera aromatica	-	-	-
	Hymenaea courbaril	Jatobá	-	-
	Peltophorum pterocarpum	Copperpod	-	-
	Swartzia simplex	-	-	-
Fabaceae-Mimosoideae	*Acacia collinsii*	Bull Horn Acacia	-	-
	Cojoba rufescens	Coral Snake tree	-	-
	Leucaena multicapitula	Frijolillo	-	-
	Enterolobium cyclocarpum	Elephant Ear Tree	-	-
	Inga sp.	-	-	-
	Pithecellobium unguis-cati	-	-	-
	Zygia longifolium	Sota caballo	-	-
	Pseudosamanea guachapele	Guachapele	-	-
	Samanea saman			
Fabaceae-Papilionoideae	*Andira inermis*	-	-	-
	Flemingia strobilifera	-	-	-
Flacourtiaceae	*Hasseltia floribunda*	-	-	-
	Casearia sp.	-	-	-
	Lacistema aggregatum	Cemp wood tree	-	-
	Lindackeria laurina	-	-	-
	Zuelania guidonia	Cagajón	-	-
Gesneriaceae	*Codonanthe sp.*	-	-	-
Haemadoraceae	*Xiphidium caeruleum*	-	-	-
Heliconiaceae	*Heliconia latispatha*	Lobster claw Heliconia	-	-
	Heliconia platystachys	Sexy Orange Heliconia	-	-
Lauraceae	*Cinnamomum triplinerve*	-	-	-
	Ocotea sp.	-	-	-
	Nectandra sp.	-	-	-
Lecythidaceae	*Gustavia superva*	Membrillo	-	-
Loganiaceae	*Strychnos sp.*	-	-	-
Loranthaceae	*Phoradendron piperoides*	-	-	-
Marantaceae	*Ischnosiphon sp.*	-	-	-
Malvaceae	*Sida sp.*	Mallow	-	-
	Taliparitiliaceum var. pernambucensis			
Melastomataceae	*Miconia impetiolaris*	Mule's Ear Miconia	-	-
	Miconia argentea	-	-	-
	Mouriri myrtilloides	-	-	-
	Miconia elata	-	-	-
Meliaceae	*Trichilia sp.*	-	-	-

Family	Scientific Name	Vernacular Name	IUCN Red List	Panamanian Law (Resolution AG-0051)
	Cedrela odorata	Spanish Cedar	VU	VU
	Guarea sp.	-	-	-
	Guarea multiflora	-	-	-
Moraceae	*Ficus insipida*	-	-	-
	Ficus obtusifolia	Strangler Fig	-	-
	Castilla elastica	Panama Rubber Tree	-	-
Muntingiaceae	*Muntingia calabura*	Panama berry	-	-
Myristicaceae	*Virola sebifera*	Red Ucuuba	-	-
Myrsinaceae	*Ardisia sp.*	Coralberry	-	-
	Alibertia edulis	Puruí	-	-
Myrtaceae	*Eugenia sp.*	-	-	-
Nyctaginaceae	*Guapira costaricana*	-	-	-
Orchidaceae	*Epidendrum sp.*	-	-	VU
	Coryanthes sp.	-	-	-
Passifloraceae	*Passiflora vitifolia*	Passiflora	-	-
	Passiflora biflora	Two-flowered passion flower	-	-
Pellicieraceae	*Pelliciera rhizophorae*	Tea Mangrove	VU	EN
Piperaceae	*Piper reticulatum*	-	-	-
	Piper marginatum	Marigold pepper	-	-
	Piper culebranum	-	-	-
	Piper aequale	-	-	-
Poaceae	*Saccharum spontaneum*	Kans Grass	-	-
	Panicum maximum	Guinea grass	-	-
	Panicum pilosum	-	-	-
	Pharus latifolius	-	-	-
	Chusquea simpliciflora	-	-	-
	Rottboellia conchinchinensis	-	-	-
Polygonaceae	*Triplaris cumingiana*	Ant tree	-	-
	Coccoloba sp.	-	-	VU
	Coccoloba Caracasana	-	-	-
	Coccoloba manzanillensis	-	-	-
Rhamnaceae	*Gouania sp.*	-	-	-
Rhizophoraceae	*Rhizophora mangle*	Red Mangrove	LC	EN
	Cassipourea elliptica	Goat wood	-	-
Rubiaceae	*Alseis blackiana*	-	-	-
	Calycophyllum candidissimum	Harino o alazano	-	-
	Faramea occiddentalis	-	-	-
	Genipa americana	Genipapo	-	-
	Macrocnemum roseum	-	-	-
	Palicourea guianensis	Recadito	-	-
	Pittoniotis trichantha	Aguacatillo	-	-
	Posoqueria latifolia	Needle-flower Tree	-	-
	Psychotria carthagenensis	Amyruca	-	-
	Psychotria horizontalis	-	-	-
	Psychotria micrantha	-	-	-
	Psychotria sp.1	-	-	-
Sapindaceae	*Allophylus occidentalis*	-	-	-
	Cupania rufescens	-	-	-
	Cupania scrobiculata	Gorgojero	-	-
	Matayba glaberrima	-	-	-

Family	Scientific Name	Vernacular Name	IUCN Red List	Panamanian Law (Resolution AG-0051)
	Matayba scrobiculata	-	-	-
	Sapindus saponaria	Wingleaf soapberry	-	-
	Serjania sp.	-	-	-
Solanaceae	*Solanum sp.*	-	-	-
Sapotaceae	*Chrysophyllum cainito*	Star Apple	-	-
	Pouteria sp.	-	-	-
Scrophulariaceae	*Scoparia dulcis*	Goatweed	-	-
Siparunaceae	*Siparuna pauciflora*	-	-	-
Sterculiaceae	*Guazuma ulmifolia*	Guácima	-	-
	Herrania purpurea	-	-	-
	Sterculia apetala	Panama tree	-	-
Tectariaceae	*Cyclopeltis semicordata*	-	-	-
	Tectaria incisa	-	-	-
Thelypteraceae	*Thelypteris poiteana*	-	-	-
Tiliaceae	*Luehea seemannii*	-	-	-
	Apeiba tibourbou	-	-	-
Verbenaceae	*Tectona grandis*	Teak	-	-
	Aegiphila sp.	-	-	-
Vitaceae	*Cissus sp.*	-	-	-

Source: Prepared by JICA Study Team based on URS Holdings, Inc. (2014)

付属資料 11-5 ベースライン調査時に確認された陸上動物種

Family Name	Scientific Name	Vernacular name	IUCN Red List	Panamanian Law (Resolution AG-0051)
Mammals				
Agoutidae	*Agouti paca*	Spotted Paca	-	VU
Cebidae	*Saguinus geoffroyi*	Geoffroy's Tamarin	-	VU
Dasypodidae	Dasypus novemcinctus	Nine-banded Armadillo	-	-
Dasyproctidae	*Dasyprocta punctata*	Central American Agouti	-	-
Didelphidae	*Didelphis marsupialis*	Black-eared Opossum	-	-
Echimyidae	*Proechimys semispinosus*	Tome's Spiny Rat	-	-
Leporidae	Sylvilagus brasiliensis	Tapeti/ Forest Rabbit	-	-
Muridae	*Sigmodon hirsutus*	Southern Cotton Rat	-	-
Phyllostomidae	*Glossophaga soricina*	Pallas's Long-tongued Bat	-	-
	Carollia perspicillata	Seba's Short-tailed Bat	-	-
	Uroderma bilobatum	Tent-making Bat	-	-
	Artibeus jamaicensis	Jamaican Fruit-eating Bat	-	-
	Platyrrhinus helleri	Heller's Broad-nosed Bat	-	-
Procyonidaqe	*Nasua narica*	White-nosed Coati	-	-
	Procyon sp.	-	-	-
Sciuridae	*Sciurus granatensis*	Red-tailed Squirrel	-	-
Birds				
Alcedinidae	*Chloroceryle americana*	Green Kingfisher	-	-
Ardeidae	*Tigrisoma mexicanum*	Bare-throated Tiger-heron	-	-
	Ardea alba	Great Egret	-	-
	Egretta caerulea	Little Blue Heron	-	-
Cathartidae	*Coragyps atratus*	Black Vulture	-	-
	Cathartes aura	Turkey Vulture	-	-
Charadriidae	*Charadrius wilsonia*	Wilson's Plover	-	-
Columbidae	*Columba cayennensis*	Pale-vented Pigeon	-	VU
	Columbina talpacoti	Ruddy Ground-dove	-	-
	Leptotila verreauxi	White-tipped Dove	-	-
	Patagioenas cayennensis	Pale-vented pigeon	-	-
Cracidae	*Ortalis cinereiceps*	Grey-headed Chachalaca	-	-
Cuculidae	*Crotophaga ani*	Smooth-billed Ani	-	-
Emberizidae	*Volatinia jacarina*	Blue-black Grassquit	-	-
Falconidae	*Milvago chimachima*	Yellow-headed Caracara	-	-
Fregatidae	*Fregata magnificens*	Magnificent Frigatebird	-	-
Icteridae	*Quiscalus mexicanus*	Great-tailed Grackle	-	-
Laridae	*Larus Sp.*	Seagull	-	-
Pelecanidae	*Pelecanus occidentalis*	Brown Pelican	-	-
Phalacrocoracidae	*Phalacrocorax brasilianus*	Neotropic Cormorant	-	-
Picidae	*Melanerpes rubricapillus*	Red-crowned Woodpecker	-	-
Psittacidae	*Amazona autumnalis*	Red-lored Amazon	-	VU
	Amazona ochrocephala	Yellow-crowned Amazon	-	VU
Strigidae	*Otus choliba*	Tropical Screech-owl	-	-
Sulidae	*Sula leucogaster*	Brown Booby	-	-
Thraupidae	*Ramphocelus dimidiatus*	Crimson-backed	-	-
	Thraupis episcopus	Blue-grey Tanager	-	-
Trochilidae	*Phaethornis anthophilus*	Pale-bellied Hermit	-	-
Tyrannidae	*Tyrannus melancholicus*	Tropical Kingbird	-	-

Family Name	Scientific Name	Vernacular name	IUCN Red List	Panamanian Law (Resolution AG-0051)
	Myiocetetes cayanensis			
Reptiles				
Alligatoridae	*Crocodylus acutus*	American Crocodile	VU	EN
Boidae	*Boa constrictor*	Boa constrictor	-	VU
Colubridae	*Oxybelis fulgidus*	Green vine snake	-	-
Corytophanidae	*Basiliscus basiliscus*	Common basilisk	-	-
Gekkonidae	*Gonatodes albogularis*	Yellow-headed gecko	-	-
Gymnophthal-midae	*Leposoma southi*	Northern Spectacled Lizard	-	-
Iguanidae	*Iguana iguana*	Green Iguana	-	VU
Polychrotidae	*Anolis limifrons*	Slender Anole	-	-
	Anolis tropidogaster	Tropical Anole	-	-
	Anolis lionotus	Lion Anole	-	-
Scincidae	*Mabuya unimarginata*	Central American Mabuya	-	-
Teiidae	*Ameiva ameiva*	Giant Ameiva	-	-
Amphibians				
Bufonidae	*Chaunus marinus*	Cane toad	-	-
	Rhaebo haematiticus	Truando Toad	-	-
Centrolenidae	*Teratohyla spinosa*	Spiny Cochran frog	-	-
Dendrobatidae	*Dendrobates auratus*	Green And Black Poison Frog	-	VU
Eleutherodac-tylidae	*Silverstoneia flotator*	Rainforest Rocket Frog	-	-
	Diasporus diastema	Common Tink frog	-	-
	Diasporus vocator	Agua Buena Robber Frog	-	-
Hylidae	*Smilisca phaeota*	Masked Tree Frog	-	-
	Smilisca sordida	Veragua cross-banded tree frog	-	-
Leiuperidae	*Engystomops pustulosus*	Tungara Frog, Túngara Frog	-	-
Leptodactylidae	*Leptodactylus savagei*	Savage's Thin-toed Frog	-	-
	Leptodactylus fragilis	American White Lipped Frog	-	-

Source: Prepared by JICA Study Team based on URS Holdings, Inc. (2014)

付属資料 11-6 ベースライン調査時に確認された水生動物種

Family Name	Scientific Name	Vernacular name
Fish		
Atherinidae	*Atherinella panamensis*	Panama Silverside
	Melaniris pachylepis	Thick scale Silverside
Carangidae	*Caranx caninus*	Crevalle Jack
	Oligoplites altus	Longjaw Leatherjacket
Clupeidae	*Lile stolifera*	Pacific Piquitinga
Engraulidae	*Anchoa argentivittata*	Silverstripe Anchovy
	Anchoa panamensis	Panama Anchovy
Gerreidae	*Diapterus peruvianus*	Peruvian Mojarra
Haemulidae	*Anisotremus dovii*	Spotted head Sargo
Mugilidae	*Mugil curema*	Silver Mullet
Scianidae	*Cynoscion squamipinnis*	Scalyfin Corvina
Tetraodontidae	*Sphoeroides annulatus*	Bullseye Puffer
Bivalves		
Arcidae	*Anadara concinna*	-
	Anadara grandis	Mangrove Cockle
Cardiidae	*Laevicardium elenense*	-
	Trachycardium elenense	-
	Trigoniocarda obovalis	-
	Trigoniocardia granifera	-
Corbulidae	*Caryocorbula nasuta*	-
Mactridae	*Mactra fonsecana*	-
	Mulinia pallida	-
Solecurtidae	*Tagelus sp.*	-
Tellinidae	*Macoma siliqua*	-
	Psammotreta aurora	-
	Tellina eburnea	-
	Tellina inaequistriata	-
	Tellina rubescens	-
Veneridae	*Dosinia dunkeri*	-
	Protothaca aspérrima	-
Echinoderms		
Cidaridae	*Eucidaris thouarsii*	Slate Pencil Urchin
Brissidae	*Brissus obesus*	-
	Metala nobilis	-
Clypeasteridaae	*Clypeaster rotundus*	-
Cynoglossidae	*Symphurus elongatus*	-
Schizasteridae	*Agassizia scrobiculata*	-
Scutellidae	*Encope micropora*	-
	Mellita longifissa	-
Diadematidae	*Diadema mexicanum*	-
Echinometridae	*Echinometra vanbrunti*	-
Toxopneustidae	*Toxopneustes roseus*	-
	Tripneustes depresus	White Sea Urchin
Gastropods		
Buccinidae	*Phos fusoides*	-
Calyptraea	*Calyptraea conica*	Chinese Hat Snail
	Calyptraea mamillaris	-

Family Name	Scientific Name	Vernacular name
	Crepidula onyx	Onyx slippersnail
	Crucibulum spinosum	Spiny Cup-and-Saucer Snail
Cancellariidae	*Cancellaria albida*	-
Columbellidae	*Cosmioconcha modeta*	-
Conidae	*Conus fergusoni*	-
	Conus gradatus	-
	Conus patricius	Patrician Cone
Melongenidae	*Melongena sp.*	-
Nactidae	*Natica elenae*	-
	Polinices uber	-
Nassariidae	*Strombina recurva*	-
Neritidae	*Nerita funiculata*	-
Terebridae	*Terebra formosa*	-
Crustaceans		
Ocypodidae	*Uca sp.*	Fiddler Crab
Balanidae	*Balanus sp.*	Barnacle
Calappidae	*Hepatus kossmanni*	-
	Raninoides benedicti	-
Stelleroidea		
Ophiotrichidae	*Ophiothrix spiculata*	Brittle Star
Linckiidae	*Pharia pyramidata*	Yellow Spotted Star

Source: Prepared by JICA Study Team based on URS Holdings, Inc. (2014)

付属資料 11-7 メトロ 3 号線事業 EMP に関する概算コスト

(1) Construction Phase

USD

Environmental Management Plan	Description	Unit Cost	Unit	Quantity	Costs	Sub Total
Mitigation Programs						
Climate, Air, Noise and Vibrations Quality Control Program						251,750.00
	Installation of acoustic barriers	9,500	km	26.5	251,750.00	
Soil Protection						930,150.00
	Construction of containment barriers, ditches and sediment traps	16,000	km	26.5	424,000.00	
	Setup of drainage works	19,100	km	26.5	506,150.00	
Surface Water Quality Control						380,275.00
	Petroleum absorbers and floating barriers	9,550	km	26.5	253,075.00	
	Oil traps in drains	4,800	km	26.5	127,200.00	
Flora Protection						482,210.50
	Tree and Grass Planting Plan in affected grassy areas (includes maintenance for 5 years)	8,750	ha	14	122,500.00	
	Flora Rescue and Recovery Plan (forest, mangroves and plantations throughout the alignment)	350	ha	28	9,800.00	
	Reforestation Plan (forest, mangroves and plantations sectors of the alignment)	7,700	ha	28	215,600.00	
	Environmental Compensation:					
	Mature secondary forest	5,000	ha	24.146	120,730.00	
	Intermediate secondary forest	3,000	ha	1.501	4,503.00	
	Young secondary forest	1,000	ha	1.873	1,873.00	
	Grassy plants	500	ha	14.409	7,204.50	
Fauna Protection						14,116.00
	Placing signs in construction areas in stations and forest areas to instruct regarding good behavior toward fauna	200	sign	36	7,200.00	
	Fauna Rescue and Relocation Plan (forest and mangrove sectors of the alignment)	247	ha	28	6,916.00	
Environmental Education Plan						120,000.00
	Preparation and Execution of the Environmental Education Plan	120	worker	1000	120,000.00	
Socio economic, Historical and Cultural						111,200.00
	Disclosure of hiring policies for labor and employment opportunities for the local population	33	worker	1000	33,000.00	
	Notification to communities of the development of construction	300	locations	20	6,000.00	

Environmental Management Plan	Description	Unit Cost	Unit	Quantity	Costs	Sub Total
	activities					
	Placement of warning and safety signalization in risk areas	3,800	area	19	72,200.00	
Environmental Supervisor						98,550.00
	Salary	19,500	year	4.5	87,750.00	
	Material and work equipment	2,400	year	4.5	10,800.00	
Social Aspects Manager						127,800.00
	Salary	26,000	year	4.5	117,000.00	
	Materials and work equipment	2,400	year	4.5	10,800.00	
Community Liaison Officer						101,475.00
	Salary	19,550	year	4.5	87,975.00	
	Materials and work equipment	3,000	year	4.5	13,500.00	
Environmental and Social Management Personnel Transportation						72,000.00
	Vehicle's (4x4)	36,000	veh.	2	72,000.00	
				Subtotal		2,689,526.50
Monitoring Plan						
Air Quality Monitoring						199,650.00
	Quarterly monitoring of vehicular emissions	14,300	year	4.5	64,350.00	
	Air quality monitoring before starting construction in Ancon Sector.	1,000	site	3	3,000.00	
	Quarterly air quality monitoring - Construction.	29,400	year	4.5	132,300.00	
Noise Emissions Monitoring (Ambient and Occupational)						233,250.00
	Quarterly occupational noise monitoring - Construction.	28,600	year	4.5	128,700.00	
	Baseline noise monitoring before construction in Ancon Sector.	750	site	3	2,250.00	
	Baseline noise monitoring before construction along the alignment.	750	site	8	6,000.00	
	Quarterly noise monitoring - Construction.	21,400	year	4.5	96,300.00	
Vibration Level Monitoring (Ambient and Occupational)						309,090.00
	Quarterly full-body vibration monitoring - Construction.	36,600	year	4.5	164,700.00	
	Baseline ambient vibration monitoring before construction in Ancon sector and alignment.	930	site	11	10,230.00	
	Quarterly ambient vibration monitoring - Construction.	29,400	year	4.5	132,300.00	
	Monitoring in case of blasts - Construction	930	site	2	1,860.00	
Surface Water Quality Monitoring						131,400.00
	Quarterly surface water quality monitoring– Construction.	29,200	year	4.5	131,400.00	
Soil Quality Monitoring						53,100.00
	Quarterly soil quality monitoring - Construction.	11,800	year	4.5	53,100.00	

Environmental Management Plan	Description	Unit Cost	Unit	Quantity	Costs	Sub Total
				Subtotal		926,490.00
				Total		3,616,016.50

Source: URS Holdings, Inc. (2014)

(2) Operation Phase

USD

Monitoring Plan	Description	Unit Cost	Unit	Quantity	Costs	Sub Total
Air Quality Monitoring						30,000.00
	Biannual air quality monitoring – Year 1 Operation.	15,000	year	1	15,000.00	
	Annual air quality monitoring – Year 2 and 3 Operation.	7,500	year	2	15,000.00	
Noise Emissions Monitoring (Ambient and Occupational)						22,000.00
	Biannual noise monitoring – Year 1 Operation.	11,000	year	1	11,000.00	
	Annual noise monitoring – Year 2 and 3 Operation.	5,500	year	2	11,000.00	
Vibration Level Monitoring (Ambient and Occupational)						22,500.00
	Annual ambient vibration monitoring - Operation.	7,500	year	3	22,500.00	
Surface Water Quality Monitoring						29,200.00
	Biannual surface water quality monitoring– Year 1 Operation.	14,600	year	1	14,600.00	
	Annual surface water quality monitoring– Year 2 and 3 Operation.	7,300	year	2	14,600.00	
Soil Quality Monitoring						12,400.00
	Biannual soil quality monitoring – Year 1 Operation.	6,200	year	1	6,200.00	
	Biannual soil quality monitoring – Year 2 and 3 Operation.	3,100	year	2	6,200.00	
Waste water monitoring						54,900.00
	Biannual monitoring of wastewater effluent at stations and at Depot area– Year 1 Operation.	27,450	year	1	27,450.00	
	Annual monitoring of wastewater effluent at stations and in Depot area (1 site) – Year 2 and 3 Operation	13,725	year	2	27,450.00	
				Total		171,000.00

Source: Prepared by JICA Study Team based on URS Holdings, Inc. (2014)

付属資料 11-8 第 4 パナマ橋事業 EMP に関する概算コスト

(1) Construction Phase

USD

Environmental Management Plan	Description	Unit Cost	Unit	Quantity	Costs	Sub Total
Mitigation Plan						
Noise and Vibrations Control Program						64,125.00
	Acoustic barriers barriers	9,500	km	6.75	64,125.00	
Soil Protection						108,000.00
	Construction of containment barriers, ditches and sediment traps	16,000	km	6.75	108,000.00	
Surface Water Quality Control						378,000.00
	Petroleum absorbers, dispersants, clean-up equipment and floating barriers	56,000	km	6.75	378,000.00	
Flora Protection						49,958.65
	Tree and Grass Planting Plan in affected grassy areas (includes maintenance for 5 years)	8,750	ha	1.655	14,481.25	
	Flora Rescue and Recovery Plan (forest and mangroves)	350	ha	2.878	1,007.30	
	Reforestation Plan (forest and mangroves)	7,700	ha	2.878	22,160.60	
	Environmental Compensation: o Mangroves	5,000	ha	0.363	1,815.00	
	o Mature secondary forest	5,000	ha	1.668	8,340.00	
	o Intermediate secondary forest	3,000	ha	0.240	720.00	
	o Young secondary forest	1,000	ha	0.607	607.00	
	o Grassy plants	500	ha	1.655	827.50	
Fauna Protection						123,039.00
	Placing signs in construction areas in stations and forest areas to instruct regarding good behavior toward fauna	200	sign	8	1,600.00	
	Fauna Rescue and Relocation Plan (forest and mangrove sectors of the alignment)	500	ha	2.878	1,439.00	
Environmental Education Plan	Preparation and Execution of the Environmental Education Plan	120	worker	1000	120,000.00	
Socio economic, Historical and Cultural						61,100.00
	Disclosure of hiring policies for labor and employment opportunities for the local population	33	worker	1000	33,000.00	
	Notification to communities of the development of construction activities	900	location	3	2,700.00	
	Placement of speed control signalization	200	sign	13	2,600.00	
	Placement of warning and safety signalization in risk areas	3,800	area	6	22,800.00	
Environmental Supervisor						87,600.00
	Salary	19,500	year	4	78,000.00	

Environmental Management Plan	Description	Unit Cost	Unit	Quantity	Costs	Sub Total
	Material and work equipment	2,400	year	4	9,600.00	
Social Aspects Manager						113,600.00
	Salary	26,000	year	4	104,000.00	
	Materials and work equipment	2,400	year	4	9,600.00	
Community Liaison Officer						90,200.00
	Salary	19,550	year	4	78,200.00	
	Materials and work equipment	3,000	year	4	12,000.00	
Environmental and Social Management Personnel Transportation						72,000.00
	Vehicle's (4x4)	36,000	vehicle	2	72,000.00	
				Subtotal		1,147,622.65
Monitoring Plan						
Air Quality Monitoring						177,800.00
	Quarterly monitoring of vehicular emissions	14,300	year	4	57,200.00	
	Air quality monitoring before starting construction in Ancon Sector	1,000	year	3	3,000.00	
	Quarterly air quality monitoring	29,400	year	4	117,600.00	
Noise Emissions Monitoring (Ambient and Occupational)						208,250.00
	Quarterly occupational noise monitoring	28,600	year	4	114,400.00	
	Baseline noise monitoring before construction in Ancon Sector	750	site	3	2,250.00	
	Baseline noise monitoring before construction along the alignment.	750	site	8	6,000.00	
	Quarterly noise monitoring	21,400	year	4	85,600.00	
Vibration Level Monitoring (Ambient and Occupational)						276,090.00
	Quarterly full-body vibration monitoring	36,600	year	4	146,400.00	
	Baseline ambient vibration monitoring before construction in Ancon sector and alignment	930	site	11	10,230.00	
	Quarterly ambient vibration monitoring	29,400	year	4	117,600.00	
	Monitoring in case of blasts	930	site	2	1,860.00	
Surface Water Quality Monitoring						116,800.00
	Quarterly surface water quality monitoring	29,200	year	4	116,800.00	
Soil Quality Monitoring						47,200.00
	Quarterly soil quality monitoring	11,800	year	4	47,200.00	
Land Subsidence Monitoring						60,000.00
	Quarterly land subsidence monitoring	15,000	year	4	60,000.00	
				Subtotal		886,140.00
				Total		2,033,762.65

Source: URS Holdings, Inc. (2014)

(2) Operation Phase

USD

Monitoring Plan	Description	Unit Cost	Unit	Quantity	Cost	Sub Total
Air Quality Monitoring						30,000.00
	Biannual air quality monitoring – Year 1 Operation.	15,000	year	1	15,000.00	
	Annual air quality monitoring – Year 2 and 3 Operation.	7,500	year	2	15,000.00	
Noise Emissions Monitoring (Ambient and Occupational)						22,000.00
	Biannual noise monitoring – Year 1 Operation.	11,000	year	1	11,000.00	
	Annual noise monitoring – Year 2 and 3 Operation.	5,500	year	2	11,000.00	
Vibration Level Monitoring (Ambient and Occupational)						22,500.00
	Annual ambient vibration monitoring	7,500	year	3	22,500.00	
Surface Water Quality Monitoring						29,200.00
	Biannual surface water quality monitoring– Year 1 Operation.	14,600	year	1	14,600.00	
	Annual surface water quality monitoring– Year 2 and 3 Operation.	7,300	year	2	14,600.00	
Soil Quality Monitoring						67,300.00
	Biannual soil quality monitoring – Year 1 Operation.	6,200	year	1	6,200.00	
	Biannual soil quality monitoring – Year 2 and 3 Operation.	3,100	year	2	6,200.00	
Waste water monitoring						54,900.00
	Biannual monitoring of wastewater effluent at stations and at Depot area– Year 1 Operation.	27,450	year	1	27,450.00	
	Annual monitoring of wastewater effluent at stations and in Depot area (1 site) – Year 2 and 3 Operation	13,725	year	2	27,450.00	
Total						225,900.00

Source: Prepared by JICA Study Team based on URS Holdings, Inc. (2014)

付属資料 11-9 メトロ 3 号線事業及び第 4 パナマ運河橋事業のモニタリング計画

Monitoring Plan	Monitoring Activity	Parameters	Implementation Period	Q*	BA*	A*	T*	O*	Responsible for Implementation
Monitoring of Air Quality	**Monitoring of Vehicle Emissions**								
	Measurement of vehicle emissions (quarterly monitoring/ 10 vehicles/ 5 years)	Emissions parameters defined in current regulations	Construction	**X**					Owner
	Monitoring of Ambient Air Quality								
	Monitoring of the air quality in the Ancón area (3 sites/ 1 measurement)	$PM_{10,}$ NO_2, SO_2, CO, CO_2 and O_3	Before beginning construction					**X**	Owner
	Monitoring of the air quality in recipients near the project (8 sites / 5 year)	$PM_{10,}$ NO_2, SO_2, CO, CO_2 and O_3	Construction	**X**					Owner
	Monitoring of the air quality in recipients near the project (8 sites / 1 year)	$PM_{10,}$ NO_2, SO_2, CO, CO_2 and O_3	Operation 1st year		**X**				Owner
	Monitoring of the air quality in sensible receptors near the project (8 sites / 2 years)	$PM_{10,}$ NO_2, SO_2, CO, CO_2 and O_3	Operation 2nd and 3rd years			**X**			Owner
Monitoring of Occupational Noise	**Monitoring of Noise in a Work Environment**								
	Dosimeters (10 workers per sector/ 5 sectors/ 5 years)	VdB	Construction	**X**					Owner
Monitoring of Ambient Noise	**Monitoring of Ambient Noise**								
	Monitoring of ambient noise in Ancón area (3 sites / 1 measurement)	Lmax, Lmin, Leq. Daily and nightly (dBA)	Before beginning construction					**X**	Owner
	Monitoring of ambient noise in sensible receptors near the project (8 sites / 5 years)	Lmax, Lmin, Leq. Daily and nightly (dBA)	Construction	**X**					Owner
	Monitoring of ambient noise in sensible receptors near the project (8 sites / 1 year)	Lmax, Lmin, Leq. Daily and nightly (dBA)	Operation 1st year		**X**				Owner
	Monitoring of ambient noise in sensible receptors near the project (8 sites / 2 years)	Lmax, Lmin, Leq. Daily and nightly (dBA)	Operation 2nd and 3rd years			**X**			Owner
t r u c t	**Monitoring of Ambient Vibration Levels**								

Monitoring Plan	Monitoring Activity	Parameters	Implementation Period	Q*	BA*	A*	T*	O*	Responsible for Implementation
	Inspections of existing structures along the alignment to verify their current condition, up to a radius of 200 meters. In the zones where blasting must be applied, the radius must be expanded up to 1,000 meters.	Presence of fissures, cracks or damages in general to the walls, floors, ceiling or beams	Before beginning construction					**X**	Owner
	Monitoring of baseline vibrations in Ancón (3 sites) and alignment (8 sites). One time measurement.	Peak Particle Velocity (mm/s)	Before site preparation					**X**	Owner
	Monitoring of ambient vibration along the alignment. (8 sites / 5 years)	Peak Particle Velocity (mm/s)	Construction	**X**					Owner
	Monitoring of ambient vibration. Exclusively in event of blasting. (2 sites / blasting)	Peak Particle Velocity (mm/s)	Construction. During blasting					**X**	Owner
	Structural integrity inspections after the use of blasting, up to 1,000 meters from the blasting site.	Presence of fissures, cracks or damages in general to the walls, floors, ceiling or beams	Construction. After blasting					**X**	Owner
	Monitoring of ambient vibration along the alignment. (8 sites / 1 year)	Peak Particle Velocity (mm/s)	Operation 1st year		**X**				Owner
	Monitoring of ambient vibration along the alignment. (10 sites /2 years)	Peak Particle Velocity (mm/s)	Operation 2nd and 3rd years			**X**			Owner
Monitoring of Occupational Vibrations	**Monitoring of Ambient Vibration Levels in Work Environments**								
	Monitoring of complete body vibration. (10 workers per sector/ 5 sectors***/ 5 years)	VdB	Construction	**X**					Owner
Monitoring of Surface Water Quality	**Monitoring of Surface Water Quality**								
	Monitoring of surface water quality (4 water courses, up and downstream the project). In other words, 2 samples per water course, in total 8 samples). (5 years)	pH, dissolved oxygen, turbidity, biochemical oxygen demand, fecal coliforms, oils and greases, metals and detergents	Construction	**X**					Owner

Monitoring Plan	Monitoring Activity	Parameters	Implementation Period	Q*	BA*	A*	T*	O*	Responsible for Implementation
	Monitoring of surface water quality (4 water courses, up and downstream the project). In other words, 2 samples per water course, in total 8 samples). (1 year)	pH, dissolved oxygen, turbidity, biochemical oxygen demand, fecal coliforms, oils and greases, metals and detergents	Operation 1st year		**X**				Owner
	Monitoring of surface water quality (4 water courses, up and downstream the project). In other words, 2 samples per water course, in total 8 samples). (2 years)	pH, dissolved oxygen, turbidity, biochemical oxygen demand, fecal coliforms, oils and greases, metals and detergents	Operation 2nd and 3rd years			**X**			Owner
Monitoring of Waste Waters	**Monitoring of Waste Water Quality**								
	Monitoring of waste waters from metro station's bathrooms (14 samples) and Depot area and equipment yard (1 sample). (1 year)	Parameters defined in current regulations, depending on the discharge point	Operation 1st year		**X**				Owner
	Monitoring of waste waters from metro station's bathrooms (14 samples) and Depot area and equipment yard (1 sample). (2 years)	Parameters defined in current regulations, depending on the discharge point	Operation 2nd and 3rd years			**X**			Owner
Monitoring of Soil Quality	**Monitoring of Soil Quality**								
	Monitoring of soil quality in areas used as fuel depots, workshops and equipment yards. (4 sites / 5 years)	Heavy metals, Hydrocarbons, Organic material, Dehydrogenase Microbial Activity	Construction	**X**					Owner
	Monitoring of soil quality in areas used as fuel depots, workshops and equipment yards. (4 sites / 1 year)	Heavy metals, Hydrocarbons, Organic material, Dehydrogenase Microbial Activity	Operation 1st year		**X**				Owner

Monitoring Plan	Monitoring Activity	Parameters	Implementation Period	Q*	BA*	A*	T*	O*	Responsible for Implementation
	Monitoring of soil quality in areas used as fuel depots, workshops and equipment yards. (4 sites / 2 years)	Heavy metals, Hydrocarbons, Organic material, Dehydrogenase Microbial Activity	Operation 2nd and 3rd years			**X**			Owner
Monitoring of Subsidence	Monitoring of the subsidence in Omar-Torrijos Interchange by visual check and measurement (only for the Fourth Panama Canal Bridge Project)	Meters	Construction	**X**					Owner
Reports**	**Follow-Up**								
	Biannual compliance reports		Construction		**X**				Owner
	Annual compliance reports		Operation (for the first 3 years)			**X**			Owner

*:Q-quarterly; BA-biannual; A-annual; T-every two years; y O-once.
**: Proposed frequencies must be adjusted to what has been established by the ANAM.
***: Number of sectors for programming and management cost calculation. Once the activities are programmed, an adjustment may be required.
Source: URS Holdings, Inc. (2014)

付属資料 11-10 環境管理計画モニタリングフォーム

Monitoring format of General Site Visit

Date:		Name and signiture:	
Weather:			
General observation in the field			
Problems	Measures taken	Actual situation (still in process to resolve or resolved)	Action to be taken

Monitoring format of Ambient Quality (Construction phase)

Air quality

Item	Unit	Measured value (mean)	Measured value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
PM_{10}	$\mu g/m^3N$			50/year 150/24 hours			McDonalds (Balboa), ACP Building 731 (Balboa), ACP Building 910 (La Boca), SENAN (Rodman), Delta station (Arraijan), Residential Arboleda (Caceres), Global Bank (Arraijan), Gas Station Puma (Parque Oeste)	Quarterly
NO_2	$\mu g/m^3N$			100/year 150/24 hours				
SO_2	$\mu g/m^3N$			80/year 365/24 hours				
CO	$\mu g/m^3N$			10,000/8hours 30,000/1hour				
O_3	$\mu g/m^3N$			157/8hours 235/1hour				

Noise

Item	Unit	Measured value	Country's Standards		Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
			Day	Night				
Noise Level Lmax. (day and night)	dB		-	-			National Police (Albrook), ACP Building 729 (Balboa), PIPSA(La Boca), SENAN (Rodman), Super Xtra (Arraijan), Residential Arboleda (Caceres), Supermarket Rey (Vista Alegre), Cemetery Colina de la Paz	Quarterly
Noise Level Lmin. (day and night)	dB		-	-				
Noise Level Leq. (day and night)	dB		60	50				

Vibration

Item	Unit	Measured value	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
Peak Particle Velocity	mm/s		50			National Police (Albrook), ACP Building 729 (Balboa), PIPSA(La Boca), SENAN (Rodman), Super Xtra (Arraijan), Residential Arboleda (Caceres), Supermarket Rey (Vista Alegre), Cemetery Colina de la Paz	Semiannually

Surface water quality

Item	Unit	Measured value (mean)	Measured value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
pH							Velasquez River, Aguacate River, One stream without name (Valle Hermos, Nuevo Arraijan), River Cope	Quarterly
Dissolved Oxygen (DO)	mg/l			>5.0				
Turbidity	NTU			<100				
Biochemical Oxygen Demand (BOD)	mg/l			<5.0				
Fecal Coliforms	UFC/100ml			<1000				
Oils & greases								
Metals								
Detergents								

Soil quality

Item	Unit	Measured value (mean)	Measured value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
Heavy metals							Area of fuel tank, workshops, and yard	Quarterly
Hydrocarbons								
Organic material								
Dehydrogenase Microbial Activity								

Monitoring format of Ambient Quality (Operation phase)

Air quality

Item	Unit	Measured value (mean)	Measured value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
PM_{10}	$\mu g/m^3N$			50/year 150/24 hours			McDonalds (Balboa), ACP Building 731 (Balboa), ACP Building 910 (La Boca), SENAN (Rodman), Delta station (Arraijan), Residential Arboleda (Caceres), Global Bank (Arraijan), Gas Station Puma (Parque Oeste)	Semiannually in the 1st year, and annually in the 2nd and 3rd year
NO_2	$\mu g/m^3N$			100/year 150/24 hours				
SO_2	$\mu g/m^3N$			80/year 365/24 hours				
CO	$\mu g/m^3N$			10,000/8hours 30,000/1hour				
O_3	$\mu g/m^3N$			157/8hours 235/1hour				

Noise

Item	Unit	Measured value	Country's Standards		Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
			Day	Night				
Noise Level Lmax. (day and night)	dB		-	-			National Police (Albrook), ACP Building 729 (Balboa), PIPSA(La Boca), SENAN (Rodman), Super Xtra (Arraijan), Residential Arboleda (Caceres), Supermarket Rey (Vista Alegre), Cemetery Colina de la Paz	Semiannually in the 1st year, and annually in the 2nd and 3rd year
Noise Level Lmin. (day and night)	dB		-	-				
Noise Level Leq. (day and night)	dB		60	50				

Surface water quality

Item	Unit	Measured value (mean)	Measured value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
pH							Velasquez River, Aguacate River, One stream without name (Valle Hermos, Nuevo Arraijan), River Cope	Semiannually in the 1st year, and annually in the 2nd and 3rd year
Dissolved Oxygen (DO)	mg/l			>5.0				
Turbidity	NTU			<100				
Biochemical Oxygen Demand (BOD)	mg/l			<5.0				
Fecal Coliforms	UFC/100ml			<1000				

Item	Unit	Measured value (mean)	Measured value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
Oils & greases								
Metals								
Detergents								

Soil quality

Item	Unit	Measured value (mean)	Measured value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Proposed Measurement Point	Frequency
Heavy metals							Area of fuel tank, workshops, and yard	Semiannually in the 1st year, and annually in the 2nd and 3rd year
Hydrocarbons								
Organic material								
Dehydrogenase Microbial Activity								

Note: "Item", "Proposed measurement point", and "Frequency" will be fixed based in the requirements of ANAM and the results of monitoring.

付属資料 11-11 住民移転計画履行確認モニタリングフォーム案

Date	Name
General observation in the field	
Results of interview with PAPs	

Problems, complains	Measures taken	Actual situation (still in process to resolve or resolved)	Action to be taken

Progress of activities

Activities	Total	Unit	Progress in quantity		Progress in %		Expected date of completion	Responsible organization
			During the week	Till	During the week	Till		
Preparation of MINI RAP								
Employment of consultants		M/M						
Update of Strategic RAP								
Implementation of census to PAPs								
Property assess								
Approval of MINI RAP by SMP								
Finalization of PAPs List		No. Of PAPs						
Progress of compensation payment		No. Of HHs						
Balboa								
Loma Coba								
Arraijan								
Nuevo Chorrillo								
Biquez								
Vista Alegre								
Nuevo Arraijan								
San Bernardino								
Hato Montana								
Progress of land acquisition		m2						
Arraijan								
Nuevo Chorillo								
Biquez								
Vista Alegre								
Hato Montana								
Progress of resplacement		No. Of HHs						
Nuevo Chorrillo								
Biquez								
Hato Montana								
Progress of economic displacement		No. Of HHs						
Balboa								
Loma Coba								
Arraijan								
Nuevo Chorrillo								
Biquez								
Vista Alegre								
Nuevo Arraijan								
San Bernardino								
Hato Montana								

付属資料 11-12 JICA 環境チェックリスト（メトロ 3 号線事業及び第 4 パナマ運河橋事業）[1]

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) N (c) N (d) N	(a) The EIA reports will be submitted to ANAM on August in 2014, and the approval will be issued within around three months after submission. One EIA report was prepared for the Metro Line 3 Project, and another for the Fourth Panama Canal Bridge Project including the improvement work of Omar-Torrijos Intersection. (b) The reports will be in the process of inspection by ANAM. (c) The reports will be in the process of inspection by ANAM. (d) The various other required permits (for example tree clearance, payment for mangrove cut, permit for explosion, permit for discharge of used and waste water, permit of water use, permit for excavation and landfill, permit for solid waste disposal, permit for hazardous wastes management, permit of work in the Canal Area by ACP, etc.) cannot be applied for before the EIAs are approved via ANAM's resolution. The ANAM resolution will include a number of conditions and permits that must be fulfilled by the promoter.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the Project and the potential impacts been adequately explained to the local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the local stakeholders? (b) Have the comments from the stakeholders (such as local residents) been reflected in the Project design?	(a) Y (b) Y	(a) Numerous public consultation meetings, stakeholder meetings and focus group discussions were held (see Table 19.2), exceeding the local procedures and rules. The general consensus among civil society, local populations and even affected people, is that the projects will bring significant positive impacts, and as such there is widescale support obtained from local stakeholders. Final information disclosure will be carried out by ANAM following approval of the EIA reports. (b) The line 3 project basic design fully reflects the opinions of PAPs and other local stakeholders. For example, the overall routing was shifted from the "Autopista" alignment to the "Panamericana" alignment, stations, bus stops and other project features were added or moved according to popular request.
	(3) Examination of Alternatives	(a) Have alternative plans of the Project been examined with social and environmental considerations?	(a) Y	(a) Project alternatives have been evaluated to a significant extent, including social and environmental considerations at all times. Alternatives for the Metro Line 3 project included routing alternatives, and technology alternatives, and for the Fourth Panama Canal Bridge project, routing alternatives were considered alongside bridge type. A tunnel alternative was also studied. For both the Metro Line 3 and Fourth Panama Canal Bridge projects, the "no project" alternative was also studied.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the Project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) Where industrial areas already exist near the route, is there a possibility that the Project will make air pollution worse?	(a) Y (b) N	(a) The construction of the project will of course generate air pollutants such as SOx, NOx, CO and PM10 however this impact will be minor, temporary, and easily mitigated for via standard mitigation measures proposed in the EIAs. The operation of both projects will have significant positive impacts on air quality. The Metro Line 3 monorail will be run on clean energy and will therefore offset / reduce air pollution that would have been generated by vehicular traffic. Likewise, although the new Fourth Panama Canal Bridge will cause a local reduction in air quality, it will cause an overall improvement in air quality and pollutant levels by reducing journey lengths and journey times. Panama has no ambient air quality standard (one is currently under preparation) however provisional limits are available. Most of the survey results are below the likely eventual standards, however several readings exceeded the provisional limits. (b) There is no industrial area near the route.
	(2) Water Quality	(a) Is there a likelihood that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a likelihood that the project will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) Y (b) N (c) Y	(a) Water quality degradation during ground clearance activities is likely due to the high rainfall in Panama and the slopes in the forest section of Metro Line 3. However, the increased sediment level in runoff water will be a fairly insignificant increase in most water bodies, which already have high TSS levels. b) It is fairly unlikely that construction or operation of the project will contaminate groundwater. (c) Panama does not have comprehensive water quality standards in place that could be exceeded by the projects' operational effluents. Nevertheless, operational effluents will be carefully collected and treated prior to discharge, so negative impacts are not expected.
	(3) Wastes	(a) Will waste generated from the Project facilities, such as stations and depot, be properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) Solid waste management will be one of the design features to be considered during detailed design for the projects, but will be required to be in accordance with the relevant legislation (Executive Decree 34 of 2007). During construction, contractors will also be bound to carrying out their work in accordance with Panamanian Laws, as well as international standards, via the Waste Management Plan that forms part of the overall Environmental Management Plan.

[1] This table is a version created by combining tables 8 (rail) and 12 (bridges) from the JICA Website.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) N	(a) The baseline surveys determined that background noise levels are already in excess of the legal limits as defined in Panamanian law at all locations where readings were taken, and at all times. The construction and operation of the new metro line and bridge will add to the already high background noise levels, but the noise increase will be restricted to the immediate project vicinity. Detailed design should include consideration for operational noise reduction. Conversely, as the metro system will offset expected increase in car numbers and traffic problems, vehicular noise will be reduced, or at least noise increase will be prevented. There is no national standard for vibrations in Panama, but the EIA determined that the negative impacts due to vibration were likely to be low to moderate.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there likelihood that the extraction of groundwater will cause subsidence (especially in case of Undergrounds/Subways)?	(a) N	(a) The metro system will be entirely above ground, and there will therefore be no significant tunneling or underground excavations. Dewatering will be required during construction at certain locations (e.g. bridge and rail support piling) but, considering the fairly low volumes and considering the ground conditions, subsidence is very unlikely, and was not considered a significant impact by the EIA studies.
3 Natural Environment	(1) Protected Areas	(a) Is the Project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the Project will affect the protected areas?	(a) N	(a) There is no protected area in/around the Project site, and it is extremely unlikely that the projects will affect protected areas.
	(2) Ecosystem	(a) Does the Project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the Project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a likelihood that installation of railroads, bridges and access roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the Project site is located at undeveloped areas, is there a likelihood that the new development will result in extensive loss of natural environments?	(a) Y (b) N (c) N/A (d) N/A (e) N (f) N	(a) The Metro Line 3 project passes through a significant area of mainly mature secondary tropical rain forest, however, as the line runs alongside the road for the majority of the alignment, a relatively small amount of clearance is required. For the same reason, the impacts of forest clearance alongside a highly disturbed area are clearly much less significant than if the clearance were occurring in an undisturbed location. The Fourth Panama Canal Bridge project element passes through a small area of mangroves on the western banks of the Canal. A Special Mangrove Management Plan has been developed as part of the EIA for the Fourth Panama Canal Bridge, to ensure that construction impacts are minimized. It should be noted that academic and NGO opinion is that the area of mangrove to be cleared during construction of the bridge is likely to regenerate fairly rapidly. Both the forest and mangrove areas to be cleared will be offset through ANAM's forestry offset program. (b) The project sites do not encompass any protected habitats, but does encompass habitats of endangered species designated by both Panamanian law and international conventions. Despite this, the EIA studies determined that the projects will not cause significant habitat loss, nor will it have effects on the protected species. (c) Severe impacts on the ecosystem are not foreseen. (d) Due to the fact that the alignment of the Metro Line 3 project is largely alongside the existing road, and due to the fact that the entire alignment is raised above ground, no impacts are expected on animal migration, severance, or habitat fragmentation. As a result, no protection measures are required. (e) No introduction of exotic species is expected. (f) The majority of the project site is not located in undeveloped areas, and passes through existing urban areas. The section that passes through forest will not result in extensive loss of natural environments due to the proximity of the alignment to the existing road, the raised nature of the alignment, and the fairly small amount of clearance required. Offset and regeneration will also take place.
	(3) Hydrology	(a) Is there a likelihood that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) The surface water flow is unlikely to be significantly affected by the presence or operation of the project, however they may be a slight increase in runoff. The construction of the project has some potential to affect surface water and groundwater flows, but the affects, if any, will be minor, and can be fairly easily mitigated.
	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, and where are such needed? (b) Is there a likelihood that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a likelihood that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) Y (c) Y	(a) The project is in a high risk area for landlsides. Although soft ground does exist in places alongside the alignment of the Metro Line 3 Project, due to the fact that the majority of the alignment is alongside or in the centre of a paved road, slope failures and landslides are not expected. (b) It is possible that cut and fill and other construction activities may cause slope failures and landslides, however it is farily unlikely, particularly when the recommended mitigation measures are implemented via the Environmental Management Plan. (c) Soil runoff is highly likely during construction, due to the nature of the terrain and the climate in Panama. Runoff will be mitigated for via the Environmental Management Plan. Example mitigation measures include installation of silt fences.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by resettlement? (b) Is adequate explanation on compensation and resettlement assistance given	(a)Y (b)Y (c)Y (d)Y	(a) Resettlement will be required for five families. The alignment was determined minimizing relocation of inhabitants. (b) All PAPs have been involved in the community participation activities during the feasibility study. (c) The RAP in accordance with the World Bank OP 4.12 was elaborated based on the census and socioeconomic

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(e)Y (f)Y (g)Y (h)Y (i)Y (j)Y	study of PAPs carried out on February to April of 2014. (d) The Strategic RAP determines the compensation is paid prior to resettlement. (e) The Strategic RAP determines the compensation policies. (f) The Strategic RAP describes the livelihood conditions of vulnerable groups and people. Special attention will be paid for vulnerable people. (g) The Strategic RAP determines that the SMP should obtain the agreements with the PAPs prior to resettlement. (h) SMP has a unit for resettlement and land acquisition. They have a successful experience in the Metro Line 1 Project. (i) A monitoring plan was elaborated out as a part of the Strategic RAP. (j) SMP will open the offices to conduct the grievance redress in the project area.
	(2) Living and Livelihood	(a) Where railways, bridges and access roads are newly installed, is there a likelihood that the Project will affect the existing means of transportation and the associated workers? Is there a likelihood that the Project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any likelihood that the Project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any likelihood that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the Project? Are adequate considerations given to public health, if necessary? (d) Is there any likelihood that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any likelihood that railways, bridges or access roads will impede the movement of inhabitants? (f) Is there any likelihood that structures associated with roads (such as bridges) will cause sun shading and radio interference?	(a) N (b) N (c) N (d) Y (e) N (f) Y	(a) Any severe impacts are not foreseen. The railways will go along the existing highway. (b) Any severe impacts are not foreseen. The project will have positive impact on the quality of life in the project area. (c) Any severe impacts are not foreseen in the environmental management plan with regards to awareness training for the workers. (d) The traffic congestion can occur during site preparation and construction, which can be minimized by controlling the working time. However, during the operation stage, situation is expected to improve. (e) Any revere impacts are not foreseen. (f) The columns of railway and of access road to the bridge probably will cause sun shading and radio interference. However, the most section of Metro Line 3 Project will go in the medium of the exiting highway, and the impact will be minimized.
4 Social Environment	(3) Heritage	(a) Is there a likelihood that the Project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) As the projects pass along fairly highly disturbed areas, and as the baseline surveys found little evidence of archaeological interest, it is not considered likely that the projects will damage local archaeological or historical resources. Likewise, the projects do not pass in proximity to any cultural or religious facilities or sites. Considerable effort was made during the EIA studies to uncover any evidence of such resources, in excess of the legal requirements. During construction, a Chance Find Procedure will be implemented to ensure that in the unlikely event of a discovery, the incident be correctly handled.
	(4) Landscape	(a) Is there a likelihood that the Project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The EIA assessment determined that the existing landscapes are “average”. Many of the sections of the projects are highly disturbed due to anthropogenic activity, and even the relatively unpopulated forested area to the West of the Canal already includes the highway. No specific measures are required for landscape mitigation during construction, however sympathetic architecture for stations, substations, and other infrastructure should be employed.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?	(a) N (b) N	(a) There is neither ethnic minorities nor traditional indigenous community in/around the Project area. (b) There is neither ethnic minorities nor traditional indigenous community in/around the Project area.
	(6) Working Conditions	(a) Is the Project proponent not violating any laws and ordinances associated with the working conditions of the country which the Project proponent should observe in the Project? (b) Are tangible safety considerations in place for individuals involved in the	(a) N (b) Y (c) Y	(a) The Project will take place in accordance with the national laws and ordinances about the working conditions (b) SMP will obligate consultants and contractors to provide safety considerations for their workers. (c) SMP will obligate consultants and contractors to implement safety and health program for their workers.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		Project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the Project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers, etc.? (d) Are appropriate measures being taken to ensure that security guards involved in the Project not to violate safety of other individuals involved, or local residents?	(d) Y	(d) SMP will obligate consultants and contractors to consider security guards for the workers.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) Y (c) Y	(a) The Environmental Management Plan, which includes a number of specific sub-plans such as a waste management plan and a flora and fauna protection plan, proposes a large number of effective mitigation measures to remove or reduce negative impacts during construction. Examples include restrictions on working hours and locations, and use of modern machinery to reduce noise and emissions, use of dust suppression equipment and regular damping to reduce dust generation, installation of silt fences and settling tanks to reduce runoff sediment loads, strict controls on waste management and storage and use of hazardous liquids, to prevent soil and water contamination, and extensive measures to prevent harm to workers or the general public. (b) The Environmental Management Plan outlines measures to reduce the negative impact of the required forest clearance, as well as proposing offset measures. (c) The RAP as well as the Environmental Management Plan is prepared to reduce impacts on social environment during construction, which will include among other measures the deployment of a full time Community Liaison Officer, regular meetings with the local communities, and implementation of a Grievance Redress Mechanism.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The proponent develops and implements the monitoring program In accordance with the Environmental Management Plan, with the support of ANAM and other related agencies. (b) The items, methods and frequencies of the monitoring program of air quality, noise and vibration are explained in 19.7.6 of this Report. (c) In accordance with the Environmental Management Plan as well as the national regulation of ANAM, SMP will establish adequate monitoring framework. (d) The proponent should periodically submit the monitoring reports to ANAM.

Source: JICA Study Team