

PUNTLAND HIGHWAY  
AUTHORITY

ROAD CONDITION  
ASSESSMENT SURVEY  
REPORT

GAROWE – BOSASO TARMAC  
ROAD

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## **LIST OF ACRONYMS**

GPS	:	Global Position System
Km	:	Kilometer
Nos	:	Numbers
RM	:	Routine Maintenance
PHA	:	Puntland Highway Authority
BOQ	:	Bill of Quantity



## **PHA Chief Executive Director's message**

On 27<sup>th</sup> February, 2022, I officiated the main road condition assessment that will help in the improvement of the Bosaso – Garowe main road, I assigned this important task to the team of engineers led by head of engineers (Said Mohamed Said), comprising the following engineers;

1. Eng. Abshir Mohamed Muse,
2. Eng. Mohamud Dahir Saidiyo
3. Eng. Abdi-mahad Mohamed farah.

The main purpose of conducting this assessment and data collection for the Bosaso – Garowe main road was to assess the state of the road, in terms of safety and condition of the 450 KM road, including identifying the exact stretch of the damaged sections, bridges, embankments and culverts that need renovation and repairs.

The report also came up with recommendations and proposal on the needed repairs and maintenance work to improve the road that will be undertaken by Puntland Highway Authority (PHA).

The finding of the report will also be an important tool in ascertaining the cost and general planning for the planned road rehabilitation project

PHA's mission is to develop and maintain a safe and enduring national road system in the Puntland State of Somalia for socio-economic development.

In the first half of 2022, PHA developed a Five-year strategic plan. One of the vital planned activities is to collect accurate and updated data for all the main roads in Puntland by assessing their quality conditions in order to develop an effective and efficient road rehabilitation plan based on data that is evident from the ground

Finally, I would like to thank each and every one who participated and took part in the exercise in one way or the other on behalf of the people and government of Puntland.

Thanks to Allah

**Abdifitah Mohamed Sugule**

**PHA chief executive Director**

## 1. Introduction

The main aim of conducting for this assessment survey, was to obtain required information of current road condition and the safety by identifying the sections required for repair/rehabilitation and maintenance to address the major defects of the road e.g. shoulder erosion, washed embankment, damaged stone pitching, overgrow vegetation, potholes and culvert drainage status.

This assessment was intended to evaluate the status and extent of damages on the road (Bosaso-Garowe) to find accurate data about the road and to develop applicable and comprehensive plan for the road maintenance and rehabilitation to sustain road quality and safety for the transport.

The current status of the road condition of Garowe-Bosaso is in hazard due to vulnerability of aged with tear and wear caused by vehicle weight, tyre wear, vehicle moving, weather as well as limited maintenance including cracks, potholes, rusted pipe culverts, deteriorated condition of bridges, washed embankments, overgrown vegetation and deteriorated side drain canals.

The most importance of this assessment is to find locations of the serious damaged part on the road in order to prevent/avoid road accident by improving road safety and to address the road conditions to sustain the road safety, quality and durability. The assessment also found recommendations and proposal on the needed repairs sections and maintenance work to improve the road condition that will be undertaken by Puntland Highway Authority (PHA).

The PHA, Executive Director has nominated the assessment team to evaluate the current status of the road in terms of safety and condition of road of 480km (Bossaso-Garowe), by identifying the degree of the damaged sections, bridges, embankments and culverts that need renovation and repairs, with proposing to develop appropriate recommendation and plan of repairing and maintenance of the road.

The mission team was comprised of the following engineers:

- |                                  |             |
|----------------------------------|-------------|
| 1. Eng. Said Mohamed Said        | Team Leader |
| 2. Eng. Abshir Mohamed Muse      | Member      |
| 3. Eng. Mohamud Dahir Said       | Member      |
| 4. Eng. Abdi-Mahad Mohamed Farah | Member      |

The objective of the assessment was to identify the extent of the damages in Garowe-Bosaso tarmac road and propose rehabilitation intervention plan with good quality and improvement of appropriate measure to ensure safety, quality and durability of the road.

The key planned questions of the assessment were, how is the current status/condition of the road between Bossaso-Garowe, how is the safety of the road and how much budget is needed for entire road rehabilitation to address the current situation of the road

## **2. Executive Summary**

The mandate of PHA as defined in the law is the development, rehabilitation and maintenance, supervision and management of roads and highway networks projects throughout the Puntland State of Somalia. PHA is also tasked with the responsibility of securing and managing infrastructure funding and resource mobilization.

In this regard, PHA with the support of the government intends to carry out rehabilitation works on the Garowe-Bossaso highway which is currently in state of dilapidation due to many years of neglect/unrepaired. To fully undertake this exercise, a detailed road condition survey is needed to be undertaken to plan and devise various interventions (detailed engineering design), but due to the length of the road (450KM), it will require a considerable period of time to carry out the exercise amicably.

As part of the rehabilitation work, PHA plans to carry out all highway related activities along with Garowe-Bosaso highway, where the priority has been given to repairing damaged sections, shoulders and embankment, potholes and rutting, part of the works will also include assessing drainage system, mainly replacing and adding corrugated iron pipe culverts, which has always led to flooding and overtopping of the road. The recent heavy rains caused a lot of damage across this critical section of the highway. In addition, the expected rains in the course of the year will make the situation worst.

The assessment “ Bosaso – Garowe road Condition assessment Survey” Conducted by Puntland Highway Authority ( PHA ) engineers was aimed at evaluating the status and condition of the damaged road sections between Garowe and Bosaso (450 km ) .The road is divided into seven sections, which comprise, Garowe to Sinujiif , Sinujiif to Dangorayo , Dangorayo to Haji khayr , Haji khayr to Qardho , Qardho to Waaciye , Waaciye to Armo and Armo to Bosaso city.

All these sections of the road have been assessed and recommendations for each section proposed in terms of the needed renovation work, which entails replacing and repairing the damaged corrugated iron pipe culverts, shoulder erosions, overgrown vegetation, eroded embankments, potholes, drain canals and stone pitching.

The Bosaso - Garowe highway was first constructed in 1988 and completed in 1990 by an Italian firm Merzario, it built the main trunk road, including its culverts and bridges. The road connects the main cities in the region and has emerged as a resilient infrastructure that drives the Puntland's socio-economic development and fosters integration for northern Somalia.

The highway has proved to be vital to any development agenda of Puntland, it links producers to markets, workers to jobs, students to school, and the sick to hospitals.

**This table shows the assessment summary data of the road**

No	Sections	Culverts (Nos. )	Shoulders (m )	Drain Canals (m)	Potholes (Nos.)	Vegetation (m)	Washed Embarkment (m)	Stone Pitching (m)	Distance km
1	Garowe - Sinujiif	30	37,166	Nil	Nil	Nil	Nil	Nil	60
2	Sinujiif - Dangorayo	8	4,720	Nil	Nil	Nil	55	9.40 m	30
3	Dangorayo - Xaji Khayr	10	7,601	Nil	Nil	Nil	1,610	37.70	40
4	Xaji khayr - Qardho	28	7,380	Nil	Nil	5,950	1,436	32.50	60
5	Qardho - Waaciye	14	2,988	Nil	2,162	10,350	1,024	5	70
6	Waaciye - Carmo	2	4,750	960	288	3,800	606	Nil	90
7	Carmo - Bosaso	50	4,200	775	186	Nil	472	Nil	100
	Total	142	68,805	1,735	2,636	20,100	5,148	75.2	460

### 3. Overview

Puntland Highway Authority (PHA) has mandated for Construction and rehabilitation of existing roads with the support of the government of Puntland intends to carry out rehabilitation works on the Garowe-Bossaso highway which is currently in state of disrepair due to years of neglect.

In December 1997, North East Somali Highway Authority (PHA) agency was established to take the leading role of all roads related programs in North Eastern regions of Somalia. It was later in 23<sup>rd</sup> February 1999 renamed Puntland Highway Authority (PHA) by a presidential decree of MW/DPS/008/99.

PHA main objective is to formulate and implement road infrastructure and airport rehabilitation programs. The agency has also been tasked with the responsibility of securing and being accountable for infrastructure funding from fuel levy, and from local and international development partners. Currently the agency has taken practical steps towards improving the existing roads and implementing a number of emergency repair works, routine maintenance programs; rehabilitation of several feeder roads and many assessment surveys undertaken to improve both paved roads and feeder roads throughout Puntland.

The Garowe - Bosaso Highway that links the major towns of Puntland has an economic and social integration importance throughout the Somalia country in general and Puntland in Particular. This tarmac road was funded and implemented and completed by Italian Government in 1990 Just before the collapse of the central government of Somalia.

The road has been not obtained any major rehabilitation and repair works since 1990. The heavy rains in the past 30 years have deteriorated the main tarmac road between Garowe to Bosaso. Different sections between Garowe and Bosaso has been damaged over the past couple of years by floods and hindered the smooth transportation of people and commodity.

Puntland Highway Authority organized 4 experienced engineers to undertake road condition assessment survey necessary for future repair and maintenance works. Some private road construction companies are currently being contracted for rehabilitating and constructing some damaged sections of the tarmac road included, Haji Khayr Village , Midigar and Bosaso – Kalabayr.

## **4. PHA Vision, Mission, Core Values and Core Functions and Responsibilities**

### **Vision**

Our vision is to be the most advanced institution in the Horn of Africa that have sufficient capacity to develop and maintain sustainable roads construction projects in Puntland.

### **Mission**

To effectively develop and maintain a safe and enduring national road system in the Puntland state of Somalia for economic development.

### **Core Values**

- ❖ Accountability
- ❖ Transparency
- ❖ Participation)
- ❖ Safety
- ❖ Efficiency and Effectiveness

## **PHA Core Functions and Responsibilities.**

1. Formulation of plans and designs that will facilitate the development, construction, rehabilitation, reconstruction and maintenance of roads in Puntland.
2. Development of standards, codes and specifications for roads and highways in Puntland.
3. Management of Puntland national roads and road right of way, including land reserves and access to road site developments
4. Financial resource mobilization and lobbying from international partners, donors, local communities and diaspora to ensure financial sustainability.
5. Implementation of road policies and regulations concerning Puntland national roads, including Puntland axle load control act.
6. Supervision of road construction companies within the concluded contracts and quality control.
7. Regulate the registration of road construction companies in the Puntland State of Somalia.
8. Management of road construction and rehabilitation contracts, including encouraging competitive tendering, supervision and quality control.
9. Development of general road network plan in Puntland.

## **5. Objectives of the Assessment**

The objectives of this road assessment survey report are to assess and identify the extent of the damages in Garowe – Bosaso tarmac road and propose rehabilitation interventions with good quality and improvement measures.

### **The objectives of the Assessment include:**

- a) To undertake Comprehensive assessment on road condition of the Garowe –Bosaso tarmac road excluding contracted Portions of the road to the local contractors financing by Puntland Government such as Midigar , Xaji khayr , Qayaadsame and Bosaso to Kalabayr sections.
- b) Proposal for rehabilitation and Road improvement measures.
- c) To prepare road assessment survey report regarding the road rehabilitation and improvement measures.

## **6. Assessment Period**

The overall period for the Road Condition Assessment Survey is 60 days:

- 10 days for field assessment survey and
- 40 days for report preparation

used for data recording within 30 days including desk study activities.

## **7. Methodology**

The following Methodologies were used to undertake the assessment

- a) **Field Assessment** – PHA engineers have visited the road by observing and examining the physical condition of Garowe – Bosaso road to evaluate the current status of the road and divided into 7 sections:
  - Garowe – Sinujiif Section
  - Sinujiif – Dangorayo Section
  - Dangorayo – Haji Khayr Section
  - Haji Khayr – Gardo Section
  - Gardo - Waaciye section
  - Waaciye – Carmo Section
  - Armo – Bosaso Section

### **b) Data Collection Tool**

Data collection tools or forms has been used to collect information from every and each component of road to help us evaluate and propose the probable correction actions required to rehabilitate, improve or construct the damaged components of the road such as Corrugated iron pipe culverts, Embankments, potholes in the carriageway, overgrown vegetation, Shoulders and eroded stone pitching.

### **c) Digital Camera and GPS**

During the field visit, the team of Engineers used digital camera to take Photos for each and every damaged component of the road as well as GPS Device to identify the exact location of the damaged Components.

### **d) Observation and measuring with tape**

Observations and measurements have been made by the PHA engineers To measure and determine the dimensions of the culverts, shoulders and Carriageway (No. of average size potholes damaged), overgrown Vegetation, damaged stone pitching, defected side drain canals and Washed Embankments.

## **8. GAROWE – BOSASO ROAD CONDITION ASSESSMENT SURVEY**

### **8.1. GAROWE – SINUJIIF ROAD SECTION**

The Garowe -Sinujiif section stretches **60km** long along Nugaal valley almost 380 km from Bosaso city starting Garowe eastern Checkpoint up to Sinujiif Village. The Engineers made observations on the status of the different components of road including defected Corrugated iron pipe culverts, carriageway (Potholes), Eroded shoulders, Embankments, stone pitching, overgrown vegetation by using PHA data collection tools.

#### **The following are the findings and observations of the engineers:**

##### **8.1.1 Status of corrugated iron pipe culvert**

The Total number of damaged corrugated iron pipe culverts within Garowe – Sinujiif section is 30 culverts.

- 13 trapped by debris and require cleaning (RM1, RM2)
- 7 culverts blocked by vegetation (RM9)
- 11 Nos. head walls gabion damaged (RM10)
- 5 Nos. wing walls gabion damaged (RM10)
- 4 Culverts has to be totally replaced (RM 6)
- 1 apron mattress dismantled and stolen (RM10)



- The Team identified in this Section additional of drainage structures needs along the alignment (10 culverts new drainage structures).

### 8.1.2 Garowe – Sinujiif Road Section Map

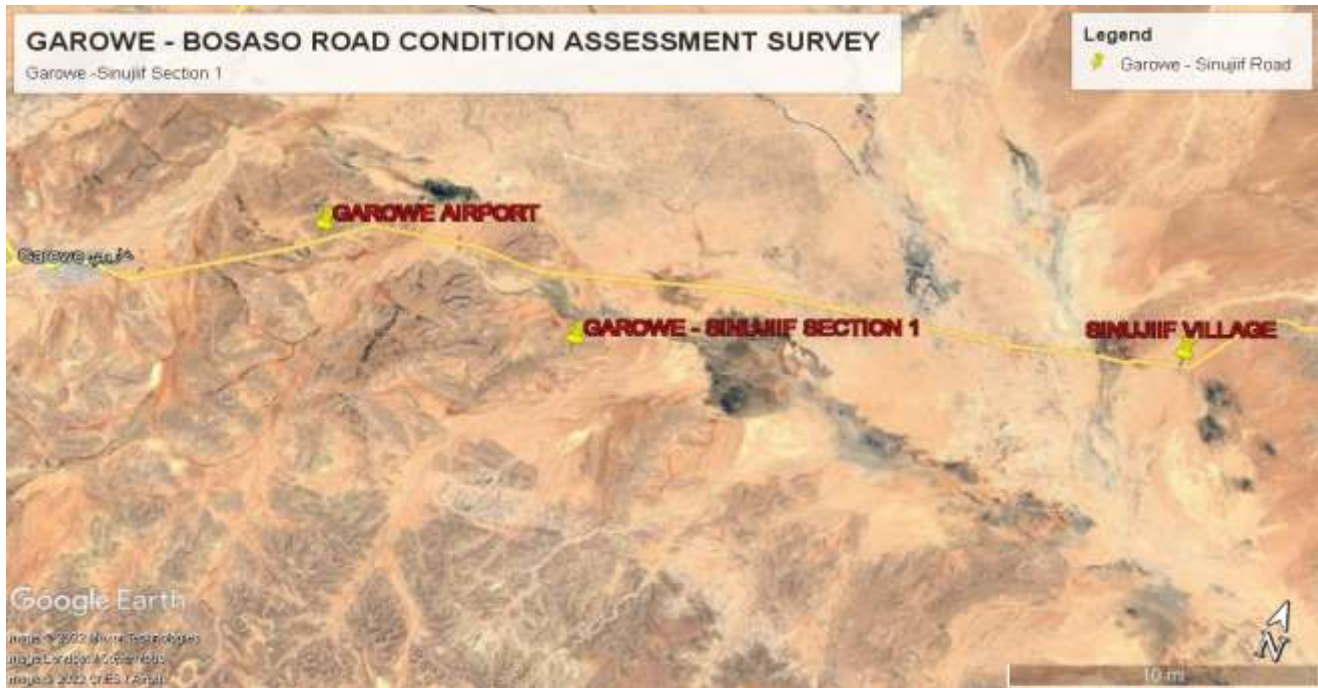


Figure 1: Garowe – Sinujiif Road Section Map

### 8.1.3 Status of Drainage Structures Garowe – Sinujiif Road Section

Table 1 Status of Drainage Structures Garowe – Sinujiif Road Section								
S.NO	Coordinates	Culvert type	Lines	W/D(m)	L(m)	Routine Maintenance (RM)	Observations	Proposed Improvement Measures
1	08.464690°N 048.60056°E	Corrugated Steel pipe	1	D=1.2	12	RM1, RM9	The outlet is blocked by scrab car and stones on the other side of the culver which is the inlet is blocked by vegetation	<i>To remove the scrab car from the outlet of the culvert and to clean up debris stones and vegetation</i>
2	08.470560°N 048.60828°E	Corrugated Steel pipe	1	D=0.7	12	RM1, RM9, RM10	Outlet blocked by stones and vegetations (50%) are blocked outlet wing wall gabions badly damaged	<i>Rehabilitation of wing wall gabions and vegetation cleaning as well soil blockage cleaning and debris stones.</i>
3	08.470930°N 048.61051°E	Corrugated Steel pipe	1	D=1.6	12	RM10, RM9	In the outlet side, head wall Gabions as well as wing walls are dismantled for a dimension of also the mattress apron heavily spoiled for the dimension of ((l=3m, w= 2m, H= 0.4), the inlet side 100% is blocked by vegetation	<ul style="list-style-type: none"> <li>- <i>Installing new head wall ang wing walls gabion or making concrete instead of gabions</i></li> <li>- <i>New concrete mattress apron</i></li> <li><i>Vegetation cleaning in the inlet side.</i></li> </ul>
4	08.472650°N 048.62280°E	Corrugated Steel pipe	1	D=0.7	12	RM10,	The outlet side 2 wing walls are damaged. The inlet 1 wing wall dismantled by water	<ul style="list-style-type: none"> <li>- <i>Rehabilitations of the 2 wing walls at the outlet side</i></li> <li><i>New wing wall at the inlet side</i></li> </ul>

5	08.473060°N 048.62542°E	Corrugated Steel pipe	1	D= 0.7	12	RM2, RM9	The inlet and outlet are blocked by Sand and small vegetation 20% are closed.	<i>Inlet and outlet vegetation and sand cleaning.</i>
6	08.474770°N 048.63690°E	Corrugated Steel pipe	1	D=1.6	12	RM10	Outlet side Head wall Gabions shade off and there is no Gabions	<i>Installing new head wall and wing walls</i>
7	08.475040°N 048.63887°E	Two span box concrete culverts	1	--	12	RM9	Inlet is blocked by small vegetation	<i>Vegetation cleaning at the inlet side.</i>
8	08.47520°N 048.64028°E	Steel pipe	1	D=1.6	12	RM2 ,RM10	Inlet and outlet 70% are blocked by sand, also the two wing walls gabion and head wall are damaged.	- <i>Replace the damaged two wing wall and head wall Inlet and outlet cleaning.</i>
9	08.47583°N 048.64425°E	Steel pipe	1	D=1.6	12	RM10	The head of both inlet and outlet are damaged	<i>Replacing the damaged head walls for inlet and outlet.</i>
10	08.476040°N 048.64569°E	Steel pipe	1	D=1.6	12	RM10	The inlet side the headwall is damaged 2m length.	<i>Rehabilitation of the damaged headwall and damaged wing walls.</i>
11	08.476250°N 048.64701°E	Steel pipe	1	D=1.6	12	RM10	The Head wall gabions damaged also there is minor damages in the wing walls.	<i>Repairing the damaged head walls and gabions.</i>
12	08.476440°N 048.64831°E	Steel pipe	1	D=1.6	12	RM10, RM9	The head gabions are little bit damaged and there is some small vegetations.	- <i>Rehabilitation of head wall gabions and vegetation cleaning.</i>
13	08.47660°N 048.64964°E	Steel pipe	1	D=1.6	12	RM1, RM10	This culver in the inlet side is blocked by garbage and rubbish also the wing wall	<i>Construction New wing walls and garbage and rubbish cleaning</i>

							gabions is washed off by water.	
14	08.476990°N 048.69174°E	Steel pipe	1	D=1.6	12	RM10	The headwall of the gabion is damaged. also, dismantle occurred in the upper part of the mattress's gabion	<i>Rehabilitation of the damaged headwall gabion and new concrete apron slab.</i>
15	08.477210°N 048.69270°E	Steel pipe	1	D=0.7	12	RM10	The head wall of the gabion is damaged badly.	<i>Construction new headwall gabion or concrete head wall.</i>
16	08.479880°N 048.70281°E	Steel pipe	1	D=0.7	12	RM2, RM9	The outlet side there is a lot of soil and vegetations so it needs to clean up.	<i>To clean the debris stones and soil blockage at the outlet side</i>
17	08.480310°N 048.70451°E	Steel pipe	1	D=1.6	12	RM10	1.4m of the head wall gabion are damaged and it needs to repair to avoid further distruction.	<i>Rehabilitation of 1.4m of the head wall gabion.</i>
18	08.480380°N 048.71482°E	Steel pipe	1	D=1.6	12	RM10	1m of the head wall gabion are damaged	<i>Rehabilitation of 1m head gabion.</i>
19	08.484640°N 048.72074°E	Steel pipe	1	D=1.6	12	RM2	75% of the pipe culvert are full by a soil, only 25% is free which having heigh of 40cm	<i>To Clear the channel of the culvert pipe for both inlet and outlet.</i>
20	08.485410°N 048.72377°E	Steel pipe	1	D=1.6	12	RM2	Totally concealed or covered by soil and it needs emergency clearance.	<i>Soil Clearing for both inlet and outlet.</i>
21	08.488230°N 048.72686°E	Steel pipe	1	D=1.6	12	RM2	90% of the canal is concealed and blocked by soil	<i>Soil and debris stone removing and clearing.</i>
22	08.487430°N	Steel pipe	1	D=1.6	12	RM2	80% of the pipe canal is	<i>Soil and debris stone</i>

	048.73111°E						concealed and blocked by soil.	<i>removing and clearing</i>
23	08.48737°N 048.73129°E	Steel pipe	1	D=1.6	12	RM2	80% of the pipe canal is concealed and blocked by soil.	<i>Soil and debris stone removing and clearing</i>
24	08.48803°N 048.73351°E	Steel pipe	1	D=1.6	12	RM2	Totally concealed or covered by soil and it needs emergency clearance.	<i>Desilting the outlet and outlet</i>
25	08.48890°N 048.73717°E	Steel pipe	1	D=0.7	12	RM2	60% is of the culvert pipe of the culvert is concealed and blocked by soil.	<i>Soil and debris stone removing and clearing</i>
26	08.48989 °N 048.74077°E	Steel pipe	1	D=1.6	12	RM6	This culvert is Totally accumulated and damaged. Also, there is corrosion and rusting and it needs total replacement.	<i>Totally replacement of the pipe culvert and damaged gabion protection in to a new concrete pipe culvert.</i>
27	08.49064°N 048.74370°E	Steel pipe	1	D=1.6	12	RM6	The head walls and wing walls are damaged. Also, there is a corrosion and rusting for both inlet and outlet sides.	<i>Replace the damaged culvert pipe section and Gabion box protection and replace to the similar corrugated GI pipe new and install concrete structure for both inlet and outlet ends, clear the inlet/outlet channels and the inside of the culvert repair defects in other section and sealing of rusted spots</i>

								<i>using mastic asphalt or surface plate welding.</i>
28	08.49379°N 048.74370°E	Steel pipe	1	D=0.7	12	RM6	The culvert cannal blocked by soil. Also, there corrosion in the steel pipe.	<i>clear the inlet/outlet channels and the inside of the culvert repair defects in other section and sealing of rusted spots using mastic asphalt or surface plate welding.</i>
29	08.49424°N 048.75720°E	Trible steel pipe	1	D <sub>1</sub> =1.6 D <sub>2</sub> =1.6 D <sub>3</sub> =1.6	12	No Problem	This culvert it's neat and clean, there is no damage at all.	<i>No action is needed.</i>
30	08.49462°N 048.75839°E	Steel Pipe	1	D=0.7	12	RM6	In this culvert, there is a blockage of soil as well as corrosion.	<i>clear the inlet/outlet channels and the inside of the culvert repair defects in other section and sealing of rusted spots using mastic asphalt or surface plate welding.</i>

### 8.1.4 Photos : Culverts for Section 1- Garowe-Sinujif

( CULVERTS No:30)



Lat 8.476201  
 Long 48.642633  
 Photo 1- showing Culvert inlet



Lat 8.495044  
 Long 48.757774  
 Photo 2- showing Culvert outlet



Lat 8.471469  
 Long 48.609832  
 Photo 3- showing Culvert inlet



Lat 8.476588  
 Long 48.645032  
 Photo 7- showing Culvert inlet



Lat 8.475626  
 Long 48.609832  
 Photo 4- showing Culvert inlet



Lat8.488484  
 Long 48.732844  
 Photo 5- showing Culvert inlet












Lat8.475366  
 Long 48.636227  
 Photo 6- showing Culvert inlet





Lat 8.485133<sup>o</sup>  
 Long 48.720127<sup>o</sup>  
 Photo 9- showing Culvert inlet



			
<p>Lat 8.473528<sup>o</sup> Long 48.824704<sup>o</sup> Photo 8- showing Culvert inlet</p>	<p>Lat 8.477177 Long 48.647651 Photo 10- showing Culvert inlet</p>	<p>Lat 8.494297 Long 48.754795 Photo 11- showing Culvert inlet</p>	<p>Lat 8.488070 Long 48.730418 Photo 12- showing Culvert inlet</p>
			
<p>Lat 8.477544 Long 48.690948 Photo 13- showing Culvert inlet</p>	<p>Lat 8.488484 Long 48.732844 Photo 14 showing culvert Inlet</p>	<p>Lat 8.477177 Long 48.647651 Photo 15- showing Culvert inlet</p>	<p>Lat 8.494297 Long 48.754795 Photo 16- showing Culvert inlet</p>
			
<p>Lat 8.488070 Long 48.730418 Photo 17- showing Culvert inlet</p>	<p>Lat 8.477554 Long 48.690948 Photo 18- showing Culvert outlet</p>	<p>Lat 8.490419 Long 48.740068 Photo 19- showing Culvert outlet</p>	<p>Lat 8.473391 Long 48.62228 Photo 20- showing Culvert outlet</p>



			
<p>Lat 8.481142 Long 48.705058 Photo 21- showing Culvert outlet</p>	<p>Lat 8.482160 Long 48.709137 Photo 22- showing Culvert outlet</p>	<p>Lat 8.473391 Long 48.622287 Photo 23- showing Culvert outlet</p>	<p>Lat 8.480315 Long 48.700802 Photo 24- showing Culvert outlet</p>
			
<p>Lat 8.471237<sup>0</sup> Long 48.607494<sup>0</sup> Photo 25- showing Culvert outlet</p>	<p>Lat 8.495044 Long 48.757774 Photo 26- showing Culvert outlet</p>	<p>Lat 8.480315 Long 48.700802 Photo 27- showing Culvert outlet</p>	<p>Lat 8.485994 Long 48.723056 Photo 28- showing Culvert outlet</p>
			
<p>Lat 8.494725 Long 48.756511 Photo 29- showing Culvert outlet</p>		<p>Lat 8.474427 Long 48.631634 Photo 30- showing Culvert outlet</p>	

### 8.1.5 Shoulder Erosion for Section 1 - Garowe-Sinujiif

✓ The team observed in this section 37.166 km defected Shoulders.

Table 2: Shoulder Erosion for Section 1 - Garowe-Sinujiif									
No	Start Coordinates		End coordinates		L	W	D	Shoulder Defects (RM4)	Proposed Improvement Measures
1	8.46445°N	48.60107°E	8.46463°N	48.60059°E	13.5	1.2	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
2	8.46472°N	48.60077°E	8.46478°N	48.60082°E	14	1.9	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
3	8.46497°N	48.60099°E	8.46517°N	48.60121°E	30	1	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
4	8.46517°N	48.60130°E	8.46535°N	48.60153°E	40	0.8	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
5	8.46552°N	48.60162°E	8.46574°N	48.60191°E	30	1	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
6	8.46568°N	48.60215°E	8.46590°N	48.60220°E	10	0.9	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

7	8.46640 °N	48.60282° E	8.4674 5°N	48.60407°E	160	0.5	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
8	8.46757 °N	48.60410° E	8.4677 5°N	48.60437°E	30	1	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
9	8.46779 °N	48.60450° E	8.4682 0°N	48.60500°E	65	1.5	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
10	8.46847 °N	48.60521° E	8.4687 0°N	48.60558°E	40	1	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
11	8.46926 °N	48.46921° E	8.4693 3°N	48.60637°E	10	0.8	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
12	8.46930 °N	48.60629° E	8.4695 1°N	48.60646°E	25	0.5	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
13	8.46952 °N	48.60659° E	8.4697 2°N	48.60686°E	20	0.6	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
14	8.46968 °N	48.60670° E	8.4699 1°N	48.60702°E	30	0.8	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

15	8.46979 °N	48.60696° E	8.4698 3°N	48.60701°E	10	1	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
16	8.46988 °N	48.60708° E	8.4700 7°N	48.60740°E	30	1.2	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
17	8.47014 °N	48.60751° E	8.6078 5°N	48.60785°E	36	1.5	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
18	8.47031 °N	48.60770° E	8.4703 8°N	48.60789°E	15	0.5	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
19	8.47046 °N	48.60836° E	8.4705 0°N	48.60852°E	30	1.3	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
20	8.47061 °N	48.60899° E	8.4708 0°N	48.61016°E	100	0.8	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
21	8.47083 °N	48.61014° E	8.4708 9°N	48.61055°E	40	1	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
22	8.47085 °N	48.61094° E	8.4711 0°N	48.61202°E	20	1.1	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

23	8.47126 °N	48.61339° E	8.4714 5°N	48.61471°E	120	1	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
24	8.47152 °N	48.61517° E	8.4715 9°N	48.61559°E	40	1.2	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
25	8.47179 °N	48.61688° E	8.4720 9°N	48.61887°E	150	0.6	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
26	08.4722 1°N	048.62011 °E	08.472 60°N	048.62243°E	150	0.7	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
27	08.4726 5°N	048.62280 °E	08.472 84°N	048.62408°E	80	0.5	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
28	08.4728 4°N	048.62408 °E	08.472 92°N	048.62455°E	20	0.5	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
29	08.4731 5°N	048.62607 °E	08.473 35°N	048.62740°E	160	0.8	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
30	08.4732 0°N	048.62617 °E	08.473 35°N	048.62740°E	80	0.6	0.02	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

31	08.4739 7°N	048.63166 °E	08.474 41°N	048.63455°E	40	0.4	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
32	08.4739 9°N	048.63169 °E	08.474 89°N	048.63781°E	350	0.5	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
33	08.4748 7°N	048.63770 °E	08.475 01°N	048.63858°E	33	0.6	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
34	08.4750 4°N	048.63888 °E	08.475 68°N	048.64326°E	320	0.7	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
35	08.4759 0°N	048.64457 °E	08.475 96°N	048.64503°E	50	0.6	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
36	08.4765 9°N	048.64892 °E	08.477 71°N	048.67566°E	1875	0.7	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
37	08.4765 4°N	048.64894 °E	08.477 13°N	048.67567°E	2150	0.8 5	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
38	08.4762 0°N	048.68760 °E	08.476 44°N	048.68771°E	160	0.8	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

39	08.4762 2°N	048.68763 °E	08.476 55°N	048.68877°E	210	0.9	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
40	08.4765 3°N	048.68990 °E	08.476 58°N	048.69014°E	35	0.8	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
41	08.4765 3°N	048.68990 °E	08.476 55°N	048.69012°E	20	0.8	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
42	08.4767 2°N	048.69070 °E	08.477 41°N	048.69315°E	210	0.8	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
43	08.4767 2°N	048.69070 °E	08.477 41°N	048.69314°E	115	0.7 5	0.04	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
44	08.4774 4°N	048.69349 °E	08.479 59°N	048.70158°E	2710	2.1	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
45	08.4774 4°N	048.69349 °E	08.479 59°N	048.70158°E	2710	1.1	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
46	08.4771 7°N	048.69224 °E	08.477 32°N	048.69303°E	70	2.1	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

47	08.4796 2°N	048.70169 °E	08.481 75°N	048.70963°E	2350	1	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
48	08.4796 2°N	048.70169 °E	08.481 75°N	048.70963°E	2120	0.5	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
49	08.4827 4°N	048.71352 °E	08.485 85°N	048.72538°E	1200	0.8	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
50	08.4827 4°N	048.71352 °E	08.485 85°N	048.72538°E	1150	0.5	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
51	08.4862 4°N	048.72685 °E	08.489 90°N	048.73845°E	650	1.2	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
52	08.4862 5°N	048.72616 °E	08.489 91°N	048.74062°E	720	1.2	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
53	08.4898 9°N	048.74072 °E	08.492 17°N	048.74936°E	800	1.3	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
54	08.4898 9°N	048.74072 °E	08.492 17°N	048.74936°E	750	0.8	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing



55	08.4922 2°N	048.74957 °E	08.495 33°N	048.76134°E	400	0.8	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
56	08.4922 3°N	048.74938 °E	08.495 33°N	048.76134°E	400	0.6	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
57	08.4953 4°N	048.76141 °E	08.498 94°N	048.77505°E	850	1	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
58	08.4953 4°N	048.76141 °E	08.498 94°N	048.77505°E	850	1	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
59	08.4989 4°N	048.77505 °E	08.506 27°N	048.81779°E	4200	1.2	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
60	08.4989 4°N	048.77505 °E	08.506 27°N	048.81779°E	4200	0.8	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
61	08.5062 8°N	048.81780 °E	08.517 48°N	048.90377°E	320	0.7	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
62	08.5774 5°N	049.04401 °E	08.577 50°N	049.04465°E	50	1	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

63	08.5778 6°N	049.04856 °E	08.578 26°N	049.05109°E	45	1	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
64	08.5806 3°N	049.05954 °E	08.580 73°N	049.05991°E	30	1	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
65	08.5808 8°N	049.06044 °E	08.580 97°N	049.06079°E	20	1	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
66	08.5810 9°N	049.06123 °E	08.581 21°N	049.06162°E	25	0.5	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
67	08.5878 9°N	049.10669 °E	08.587 90°N	049.10722°E	30	0.6	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
68	08.5879 1°N	049.10735 °E	08.587 99°N	049.10862°E	900	0.2	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
69	08.5880 4°N	049.10904 °E	08.588 07°N	049.10936°E	35	0.5	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
70	08.5883 2°N	049.11108 °E	08.588 49°N	049.11266°E	150	1	0.3	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

71	08.5884 2°N	049.11108 °E	08.588 47°N	049.11264°E	40	0.7	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
72	08.5889 3°N	048.11622 °E	08.588 96°N	049.11675°E	35	0.8	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
73	08.5889 1°N	049.11770 °E	08.588 78°N	049.11848°E	60	0.7	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
74	08.5879 1°N	049.12113 °E	08.587 31°N	049.12282°E	80	0.6	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
75	08.5879 2°N	049.12111 °E	08.587 31°N	049.12282°E	35	0.5	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
76	8.58647 °N	49.12535° E	8.5859 9°N	49.12664°E	75	1	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
77	8.58612 °N	49.12629° E	8.5856 5°N	49.12645°E	35	0.8	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
78	8.58413 °N	49.13211° E	8.5835 2°N	49.13380°E	40	0.8	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

79	8.58413 °N	49.13211° E	8.5835 2°N	49.13380°E	25	0.6	0.03	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
80	8.58289 °N	49.13565° E	8.5822 8°N	49.13737°E	85	1	0.1	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
81	8.58289 °N	49.13565° E	8.5822 8°N	50.13737°E	55	0.8	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
82	8.58060 °N	49.14230° E	8.5933 7°N	49.19573°E	850	0.8	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing
83	8.58060 °N	49.14230° E	8.5933 7°N	49.19573°E	850	0.7	0.05	Shoulder Erosion	Construction of shoulder pavement and applying single surface dressing

### 8.1.6 Photos : Shoulder erosion for Section 1- Garowe-Sinujif

		
Shoulder erosion picture (RM4) @ Garowe-sinujif section	Shoulder erosion picture (RM4) @ Garowe-sinujif section	Shoulder erosion picture (RM4) @ Garowe-sinujif section
		
Shoulder erosion picture (RM4) @ Garowe-sinujif section	Shoulder erosion picture (RM4) @ Garowe-sinujif section	Shoulder erosion picture (RM4) @ Garowe-sinujif section

### 8.1.7 Potholes for Section 1 - Garowe-Sinujif

✓ The team didn't identify any Potholes in this section

### 8.1.8 Vegetation for Section 1 - Garowe-Sinujif

✓ The team didn't identify any vegetation in this section

**8.1.9 Washed embankment for Section 1 - Garowe-Sinujiif**

- ✓ The team didn't identify any Washed embankment in this section

**8.1.10 Damaged stone pitching for Section 1 - Garowe-Sinujiif**

- ✓ The team didn't identify any damaged stone pitching in this section

**8.1.11 Accumulated Drain Canal for Section 1 - Garowe-Sinujiif**

- ✓ The team didn't identify any Accumulated Drain Canal in this section

## **8.2 SINUJIIF – DANGORAYO VILLAGE ROAD SECTION**

The Sinujiif – Dangorayo Village road section stretches 60km from Sinujiif to Dangorayo district. The Engineers observed on the status of the different components of the road including defected Corrugated iron pipe culverts , carriageway ( Potholes ) , Eroded shoulders , Embarkments , stone pitching , overgrown vegetation by using PHA data collection tools.

**The following are the findings and observations of the engineers:**

### **8.2.1. Status of corrugated iron pipe culvert**

The Total number of damaged corrugated iron pipe culverts within Sinuijif- Dangorayo road section is 8 culverts.

- 4 trapped by debris and require cleaning (RM1, RM2)
- 3 Nos head wall gabions damaged ( RM10)
- 2 Nos wingwall gabions damaged (RM10)
- 1 culvert blocked by vegetation ( RM9)

### **8.2.2 Sinujiif-Dangorayo Road Section Map**

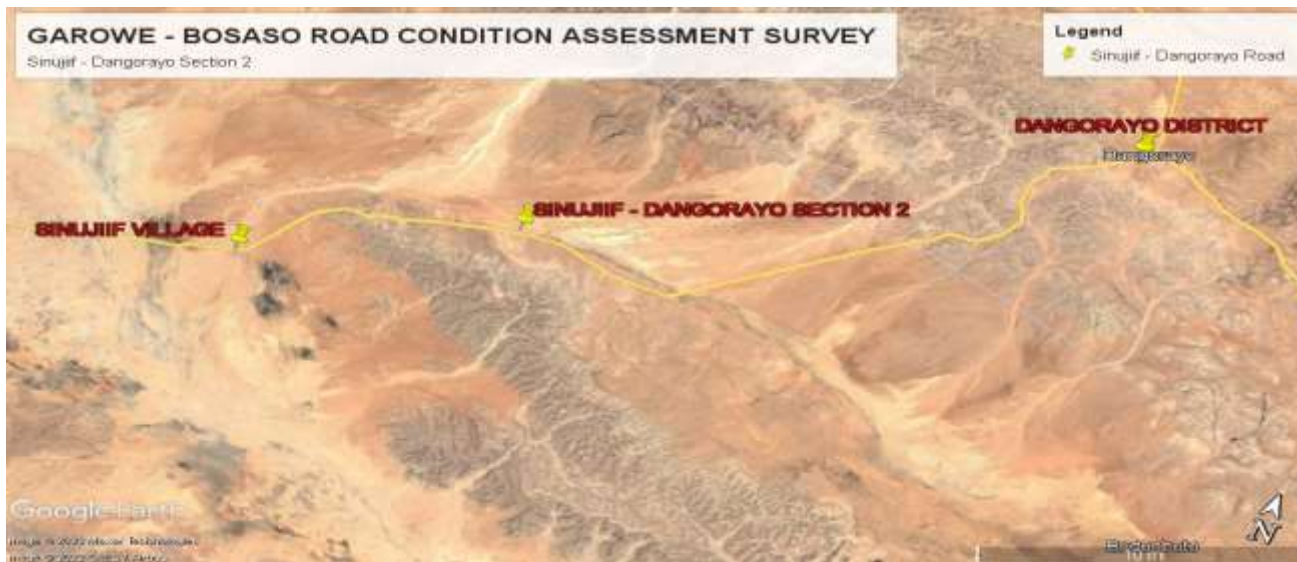


Figure 2: Sinujiif-Dangorayo Road Section Map

### 8.2.3 Status of Drainage Structures Section 2- Sunajif – dangorayo

Table 3: Status of Drainage Structures Section 2- Sunajif – dangorayo								
1	08.58106°N 049.06118°E	Steel pipe	1	D=0.7	14	RM9	This culvert in the inlet side there is some vegetations which needs to remove it. But, structurally its stable.	<i>Vegetation clearing</i>
2	08.58786°N 049.10571°E	Steel pipe	1	D=1.2	14	RM10	There is minor damage in the headwall gabions	<i>Minor rehabilitation in the head wall gabions.</i>
3	08.58791°N 049.10735°E	Steel pipe	1	D=0.7	14	RM10	This Culvert the wing walls and head walls are damaged in the outlet side.	<i>Reconstructing of the wing walls and headwall in the outlet side.</i>
4	08.60244°N 049.20720°E	Steel pipe	1	D=0.8 approximately	14	RM2	Totally concealed/covered by soil (libaaxo)	<i>Emergency Soil clearing/removing</i>
5	08.60484°N 049.21028°E	Steel pipe	1	D=0.8 approximately	14	RM2	Totally concealed and covered by soil and stones	<i>Emergency Soil and debris stone clearing/removing.</i>
6	08.61252°N 049.22034°E	Two steel pipes	1	D <sub>1</sub> =0.8 D <sub>2</sub> =0.8	14	RM2	Totally covered and closed by soil for both sides (inlet and outlet)	<i>Emergency Soil clearing/removing</i>
7	08.64244°N 049.26084°E	Steel pipe	1	D=0.8	14	RM1	3m <sup>3</sup> of stones are in the inlet side which disturbs in the water way of the culvert.	<i>Debris stone cleaning.</i>
8	08.66632°N 049.30024°E	Steel pipe	1	D=1.6	14	RM10	This culvert, there is a damage in the wing walls and head wall gabions. On the other side the pipe is clean.	<i>Rehabilitation of the damaged wing walls and headwall.</i>



**8.2.4 Photos : Culverts for Section 2- Sinujiif-Dangorayo**



Lat 8.588438  
 Long 49.106712  
 Photo 36- showing Culvert outlet



Lat 8.578163  
 Long 49.045473  
 Photo 36- showing Culvert outlet



Lat 8.769945  
 Long 49.336997  
 Photo 36- showing Culvert outlet



Lat 8.769945  
 Long 49.336997  
 Photo 39- showing Culvert outlet



Lat 8.769945  
 Long 49.336997  
 Photo 36- showing Culvert outlet



Lat 8.769945  
 Long 49.336997  
 Photo 36- showing Culvert outlet



Lat 8.605429  
 Long 49.209579  
 Photo 38- showing Culvert outlet



Lat 9.094832  
 Long 49.210784  
 Photo 39- showing Culvert outlet

### 8.2.5 Shoulder Erosion for Section 2 – Sinujiif-Dangoroyo

✓ The team observed on this Section 4.720 km Defected Shoulder

Table 4: Shoulder Erosion for Section 2 – Sinujiif-Dangoroyo									
No	Start Coordinates		End coordinates		L	W	D	Shoulder Defects (RM4)	Proposed Improvement Measures
84	8.5939 4°N	49.19593° E	8.6048 7°N	49.21029°E	350	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
85	8.5939 4°N	49.19593° E	8.6048 7°N	49.21029°E	225	0.3	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
86	8.6048 9°N	49.21026° E	8.6067 5°N	49.21272°E	700	0.8	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
87	8.6048 9°N	49.21026° E	8.6067 5°N	49.21272°E	700	0.4	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
88	8.6067 5°N	49.21272° E	8.6424 6°N	49.26048°E	520	0.4	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
89	8.6067 5°N	49.21272° E	8.6424 6°N	49.26048°E	520	0.5	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
90	8.6524 7°N	49.28314° E	8.6773 4°N	49.29999°E	760	0.8	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
91	8.6773 4°N	49.29998° E	8.7004 7°N	49.30257°E	540	0.8	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
92	8.6773 4°N	49.29998° E	8.7004 7°N	49.30257°E	405	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing

**8.2.6 Photos : Shoulder erosion for Section 2- Sinujiif-Dangorayo**



Shoulder erosion picture (RM4)  
@ Sinujiif-Dangorayo section



Shoulder erosion picture (RM4)  
@ Sinujiif-Dangorayo section



Shoulder erosion picture (RM4)  
@ Sinujiif-Dangorayo section



Shoulder erosion picture (RM4)  
@ inujiif-Dangorayo section



Shoulder erosion picture (RM4)  
@ Sinujiif-Dangorayo section



Shoulder erosion picture (RM4)  
@ Sinujiif-Dangorayo section

**8.2.7 Status of Washed Embankment for Section 2- Sinujiif-Dangorayo**

✓ Embankment erosion is 55m in length.

Table 5: Status of Washed Embankment for Section 2- Sinujiif-Dangorayo								
NO	START COORDINATES		END COORDINATES		LENGTH	AVERAGE DEPTH	DEFECTS (RM5)	Proposed improvement measure
1	8.58840°N	49.11153°E	8.58845°N	49.11198°E	55	0.4	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.



**8.2.8 Photos : Washed Embankment for Section 2- Sinujiif-Dangoroyo**



**Washed Embankment (RM5)  
@ Sinujiif-Dangoroyo section**



**Washed Embankment (RM5)  
@ Sinujiif-Dangoroyo section**



**Washed Embankment (RM5)  
@ Sinujiif-Dangoroyo section**



**Washed Embankment (RM5)  
@ Sinujiif-Dangoroyo section**



**Washed Embankment (RM5)  
@ Sinujiif-Dangoroyo section**



**Washed Embankment (RM5)  
@ Sinujiif-Dangoroyo section**

### 8.2.9 Status of Stone Pitching for Section 2- Sinujiif-Dangorayo

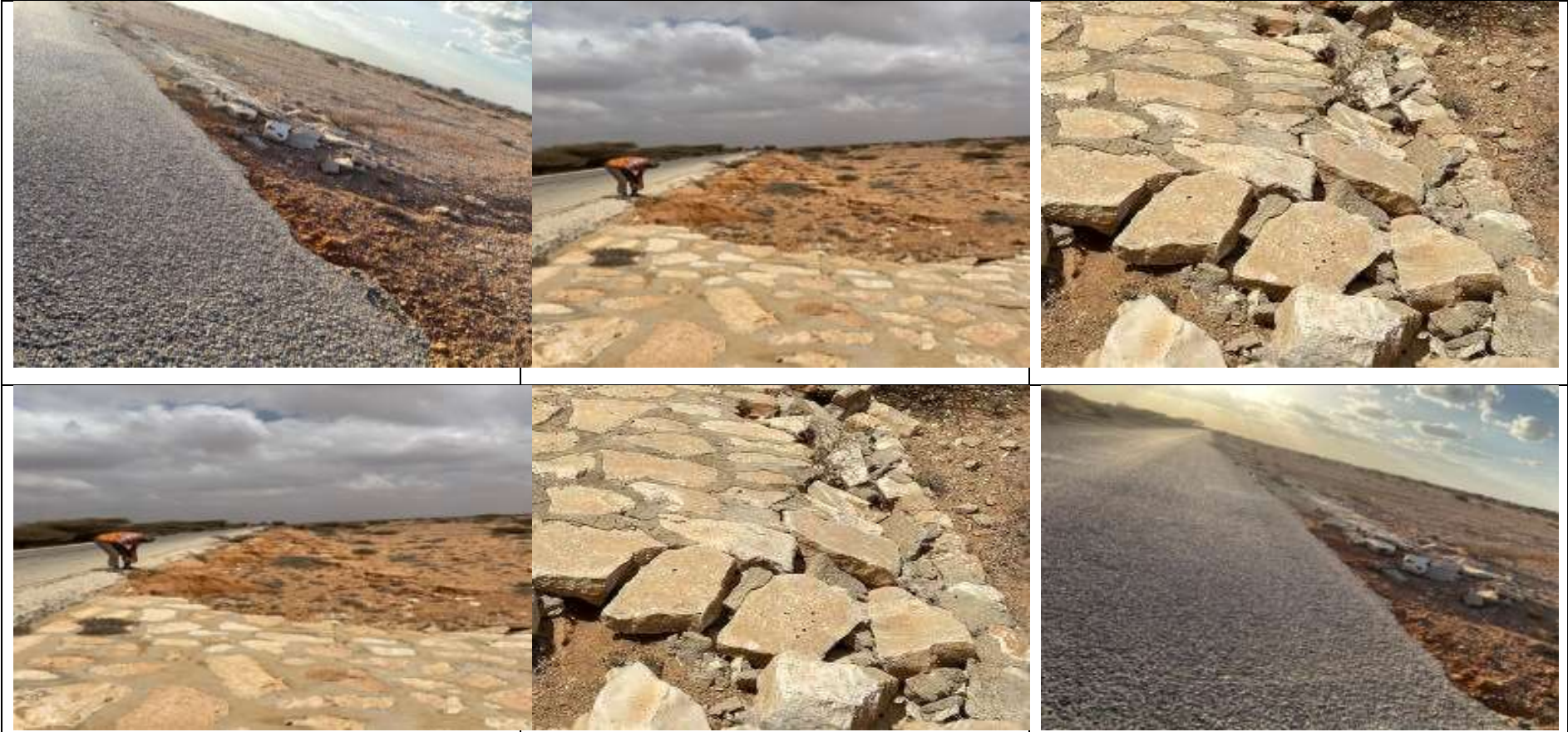
- ✓ The length of eroded stone pitching is 9.4

**Table 6: Status of Stone Pitching for Section 2- Sinujiif-Dangorayo**

<b>NO</b>	<b>COORDINATES</b>		<b>LENGTH</b>	<b>AVERAGE WIDTH</b>	<b>DEFECTS (RM5)</b>	<b>PRPOSED IMPROVEMENT MEASURE</b>
1	8.58838°N	49.11119°E	3.5	1.1	3 years ago, there were heavy rain falls in Puntland regions which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
2	8.58839°N	49.11128°E	4.4	1.3	3 years ago, there were heavy rain falls in Puntland regions, which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
3	8.58841°N	49.11141°E	1.5	1.2	3 years ago, there were a heavy rain falls in Puntland regions, which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired



#### 8.2.10 Photos : Stone Pitching for Section 2- Sinujiif-Dangorayo



#### 8.2.11 Potholes for Section 2- Sinujiif-Dangorayo

- ✓ The team didn't identify any Potholes in this section

#### 8.2.12 Vegetation for Section 2- Sinujiif-Dangorayo

- ✓ The team didn't identify any vegetation in this section

#### 8.2.13 Accumulated Drain Canal for Section 2- Sinujiif-Dangorayo

- ✓ The team didn't identify any Accumulated Drain Canal in this section

## **8.3 DANGORAYO – HAJI KHAYR VILLAGE ROAD SECTION**

The Dangorayo – Haji khayr road section stretches 50km from Dangorayo district to Haji Khayr Village. The Engineers observed on the status of the different components of the road including defected Corrugated iron pipe culverts, carriageway (Potholes), Eroded shoulders, Embankments, stone pitching, overgrown vegetation by using PHA data collection tools.

The following are the findings and observations of the engineers:

### **8.3.1 Status for corrugated iron pipe culvert**

The Total number of damaged corrugated iron pipe culverts within Garowe – Sinujiif section is 10 culverts.

- 4 trapped by debris and require cleaning (RM1,RM2)
- 1 culverts blocked by vegetation (RM9)
- 8 Nos of head wall gabions damaged (RM10)
- 5 Nos of wing wall gabions damaged ( RM10)
- 1 Culvert has to be totally replaced (RM6)
- Identification of 5 additional drainage needed along the alignment.
- The team identified cases of trapped debris at inlet of culverts that would indicate incorrect size, inlet or outlet channel inefficiencies.

### **8.3.2 Dangorayo-Haji khayr Road Section Map**

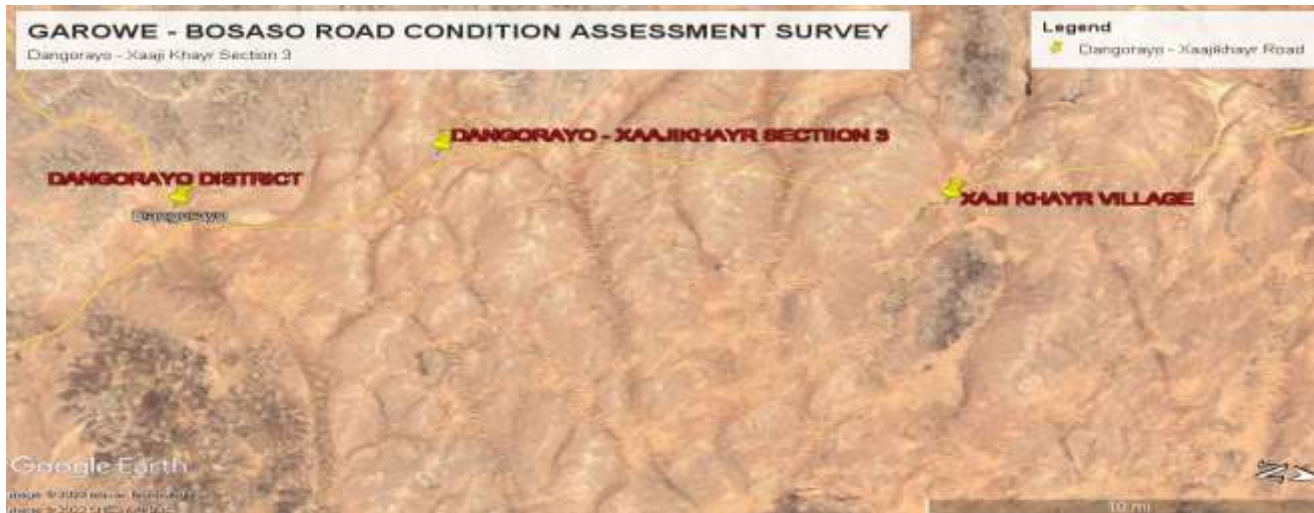


Figure 3: Dangorayo-Haji khayr Road Section Map



### 8.3.3 Status of Drainage Structures for Section 3- Dangorayo to Haji-khayr

Table 7: Status of Drainage Structures for Section 3: Dangorayo to Haji-khayr								
NO	Coordinates	Culvert type	Lines	W/D(m)	L(m)	Routine Maintenance (RM10 )	Observations	Proposed Improvement Measures
1	08.84103°N 049.27568°E	Steel pipe	1	D=0.8	16	RM10 ,	This culvert, there is a heavy damage in the gabions as well as the embankment.	<i>Replacing the damaged wing walls and headwall in to concrete structure and rehabilitation of the embankment</i>
2	08.84170°N 049.27548°E	Steel pipe	1	D=0.8	16	RM10	The pipe is clear but there is minor damage in the gabions.	<i>Minor rehabilitation in the damaged gabions.</i>
3	08.88017°N 049.27206°E	Steel pipe	1	D=1.2	16	RM10	This culvert, there is destruction in the head wall gabions for both inlet and outlet, for dimension of (l=6m and w=1m)	<i>Reconstructing the damaged headwall gabions for both inlet and outlet sides.</i>
4	08.88537°N 049.27185°E	Steel pipe	1	D=1.2	16	RM10	There is a destruction for the head wall gabions for both sides of the culvert.	<i>Reconstructing the damaged headwall gabions for both inlet and outlet sides.</i>
5	08.88743°N 049.27175°E	Steel pipe	1	D=1.2	14	RM1, RM9, RM10	This Culvert there is demolition for the head wall gabions. Also, there is an obstruction of vegetation as well as stones (which needs to clean up)	- <i>Rehabilitation of headwall gabions And removing the obstruction of vegetation and debris stones.</i>
6	08.88971°N	Steel pipe	1	D=1.2	14	RM1, RM10	The head wall gabion is	- <i>Rehabilitation of</i>

	049.27155°E						damaged as well as there is obstruction in the inlet side of the culvert caused by stones.	<i>headwall gabions And removing the obstruction debris stones.</i>
7	08.93032°N 049.27149°E	Steel pipe	1	D=1.2	14	RM1, RM10	Head wall and wing walls gabions shows much destruction in the outlet side of the culvert and also, there is stone obstruction.	- <i>Rehabilitation of headwall gabions And removing the obstruction of debris stones.</i>
8	08.96498°N 049.27455°E	Steel pipe	1	D=0.8	14	RM1, RM10	the wing walls gabion are dismantled and 2m <sup>3</sup> of stones are in the canal outlet side of the culvert.	- <i>Rehabilitation of the wing walls gabions And removing the obstruction of 2m<sup>3</sup> debris stones.</i>
9	08.96316°N 049.27959°E	Double Steel pipe	1	D=1.2 D=1.2	14	RM6	Both of these two steel canals are rusted/corrosion also, the wing walls and heads walls are totally collapse (L=5m, W=2m)	<i>Both of these canals need to replace the damaged culvert pipe section and Gabion box protection and replace to the similar corrugated GI pipe new and install concrete structure for both inlet and outlet ends, clear the inlet/outlet channels and the inside of the culvert repair defects in other section and sealing of rusted spots using mastic asphalt or surface plate welding.</i>
10	08.97267°N 049.27448°E	Steel pipe	1	D=0.7	14	RM 10	The two wing walls and head wall gabions are totally dismantled and collapse (L=3m, W=1, H=0.5m) L=2m, W=1m.	<i>Reconstructing the damaged headwall and wing wall gabions for both inlet and outlet sides.</i>

### 8.3.4 Photos: Culverts for Section 3- Dangorayo-Haji Khayr



Lat8.930869  
 Long 49.270730  
 Photo 52- showing Culvert outlet



Lat 8.965603  
 Long 49.274039  
 Photo 53- showing Culvert outlet



Lat8.963826  
 Long 49.273944  
 Photo 54- showing Culvert outlet



LAKE ATHABASCA CANADA  
 Latitude: 8.930869° Longitude 49.270730°  
 LOCAL 162124 GMT 132124 MONDAY 02.28.2022 ALTITUDE 817 METER



Lat8.973412  
 Long 49.272454  
 Photo 52- showing Culvert outlet



Lat8.983482  
 Long 49.273859  
 Photo 52- showing Culvert outlet



LAKE ATHABASCA CANADA  
 Latitude: 8.768945° Longitude 49.336997°  
 LOCAL 162124 GMT 132124 MONDAY 02.28.2022 ALTITUDE 817 METER



LAKE ATHABASCA CANADA  
 Latitude: 8.965603° Longitude 49.274039°  
 LOCAL 162124 GMT 132124 MONDAY 02.28.2022 ALTITUDE 840 METER

### 8.3.5 Shoulder Erosion for Section 3– Dangorayo - Haaji Khayr

✓ The team observed on this Section 7.601 km Defected Shoulder

Table 8: Shoulder Erosion for Section 2 – Dangorayo - Xaaji Khayr									
No.	Start Coordinates		End coordinates		L	W	D	Shoulder Defects (RM4)	Proposed Improvement Measures
93	8.70045° N	49.30258° E	8.7223 3°N	49.33747°E	610	1	0.0 6	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
94	8.70045° N	49.30258° E	8.7223 3°N	49.33747°E	480	0.6	0.0 4	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
95	8.75501° N	49.34020° E	8.7679 7°N	49.33788°E	120	0.8	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
96	8.75501° N	49.34020° E	8.7679 7°N	49.33788°E	130	0.6	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
97	8.76797° N	49.33788° E	8.7691 5°N	49.33775°E	130	1	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
98	8.76797° N	49.33788° E	8.7691 5°N	49.33775°E	115	1.5	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
99	8.76912° N	49.3370°E	8.7698 1°N	49.33757°E	67	1.2	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
100	8.76981° N	49.33757° E	8.7700 8°N	49.33758°E	71	1.3	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
101	8.77048° N	49.33755° E	8.7818 9°N	49.33095°E	560	1.2	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
102	8.77048° N	49.33755° E	8.7818 9°N	49.33095°E	210	0.8	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
103	8.78351° N	49.32886° E	8.8193 7°N	49.28504°E	2440	0.7	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
104	8.78351°	49.32886°	8.8193	49.28504°E	300	0.6	0.0	Shoulder erosion	Construction of shoulder pavement

	N	E	7°N				5		and applying single surface dressing
105	8.81983° N	49.28482° E	8.8393 1°N	49.27643°E	50	0.6	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
106	8.81983° N	49.28482° E	8.8393 1°N	49.27643°E	35	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
107	8.84178° N	49.27537° E	8.8569 8°N	49.27313°E	355	0.7	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
108	8.84178° N	49.27537° E	8.8569 8°N	49.27313°E	205	0.4	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
109	8.86644° N	49.27262° E	8.8891 7°N	49.27168°E	345	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
110	8.86644° N	49.27262° E	8.8891 7°N	49.27168°E	103	0.3	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
111	8.94116° N	49.27291° E	8.9649 4°N	49.27453°E	600	0.8	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
112	8.94116° N	49.27291° E	8.9649 4°N	49.27453°E	100	0.5	0.0 4	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
113	8.96656° N	49.27449° E	8.9665 9°N	49.27448°E	60	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
114	8.96656° N	49.27449° E	8.9665 9°N	49.27448°E	40	0.4	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
115	8.98178° N	49.27456° E	9.0052 6°N	49.25570°E	285	0.6	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
116	8.98178° N	49.27456° E	9.0052 6°N	49.25570°E	190	0.5	0.0 4	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing



**8.3.6 Photos : Shoulder erosion for Section 3- Dangorayo-Haji Khayr**



**SHOULDER EROSION (RM4)  
@ DANGORAYO-HAJI KHAYR  
SECTION**



**SHOULDER EROSION (RM4)  
@ DANGORAYO-HAJI KHAYR  
SECTION**



**SHOULDER EROSION (RM4)  
@ DANGORAYO-HAJI KHAYR SECTION**



**SHOULDER EROSION (RM4)  
@ DANGORAYO-HAJI KHAYR  
SECTION**



**SHOULDER EROSION (RM4)  
@ DANGORAYO-HAJI KHAYR  
SECTION**



**SHOULDER EROSION (RM4)  
@ DANGORAYO-HAJI KHAYR  
SECTION**

### 8.3.7 Status of Washed Embankment for Section 3- Dangorayo-Haji Khayr

- ✓ The length of the washed embankments is 1.610km Identification of additional drainage needs along the alignment.
- ✓ The team identified of Embankment erosion that indicates frequent overtopping.

Table 9: Status of Washed Embankment for Section 3- Dangorayo-Haji Khayr

NO	START COORDINATE S		END COORDINATES		LENG TH	AVER AGE DEPTH	DEFECTS (RM5)	Proposed improvement measure
2	8.83 913° N	49.27650° E	8.83994° N	49.27615° E	100	0.8	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
3	8.83 994° N	49.27615° E	8.84068° N	49.27581° E	90	1.1	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
4	8.84 068° N	49.27581° E	8.84161° N	49.27541° E	110	1.1	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
5	8.85 478° N	49.27325° E	8.85716° N	49.27314° E	250	0.3	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
6	8.85 716° N	49.27314° E	8.85798° N	49.27306° E	100	0.6	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
7	8.85 798° N	49.27306° E	8.85841° N	49.27308° E	50	0.7	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.

8	8.85 841° N	49.27308° E	8.86176° N	49.27288° E	375	1.6	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
9	8.86 176° N	49.27288° E	8.86382° N	49.27274° E	275	0.5	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
10	8.88 917° N	49.27168° E	8.89205° N	49.27153° E	310	0.7	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.



**8.3.8 Photos : Washed Embankment for Section 3- Dangoroyo-Haji Khayr**



### 8.3.9 Status of Stone Pitching for Section 3- Dangorayo-Haji Khayr

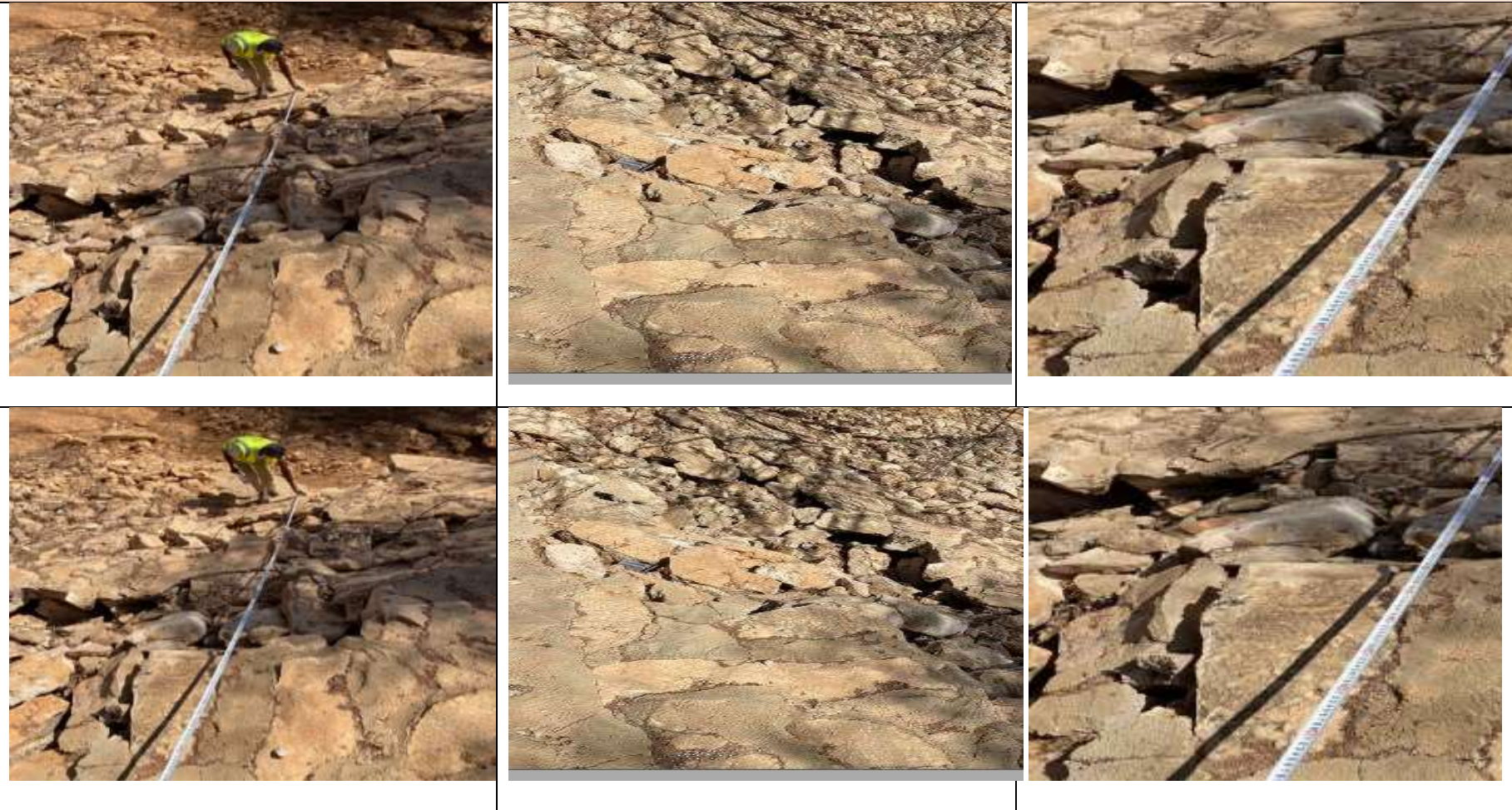
✓ The length of the eroded stone pitching is 37.70M

Table 10: Status of Stone Pitching for Section 3- Dangorayo-Haji Khayr						
Section Three Dangorayo-Haji Khayr						
NO	COORDINATES		LENGTH	AVERAGE WIDTH	DEFECTS (RM5)	PRPOSED IMPROVEMENT MEASURE
4	8.93207°N	49.27168°E	4	3.6	3 years ago, there were heavy rain falls in Puntland region which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
5	8.93250°N	49.27176°E	2.7	1.5	3 years ago, there were heavy rain falls in Puntland region which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
6	8.93254°N	49.27180°E	7.1	1.4	3 years ago, there were heavy rain falls in Puntland region which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
7	8.93258°N	49.27186°E	5.5	3	3 years ago, there were heavy rain falls in Puntland region which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
8	8.93270°N	49.27188°E	6	2.7	3 years ago, there were heavy rain falls in Puntland region which	The defected stone pitching on the embankment is essential for

					generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	protection against erosion of the embankment and has to be repaired
9	8.93275°N	49.27189°E	8.7	2.4	3 years ago, there were heavy rain falls in Puntland region which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
10	8.93283°N	49.27185°E	3.7	0.4	3 years ago, there were heavy rain falls in Puntland region which generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired



### 8.3.10 Photos: Stone Pitching for Section 3- Dangorayo-Haji Khayr



### 8.3.11 Potholes for Section 3- Dangorayo-Haji Khayr

- ✓ The team didn't identify any Potholes in this section

### 8.3.12 Vegetation for Section 3- Dangorayo-Haji Khayr

- ✓ The team didn't identify any vegetation in this section

### 8.3.13 Accumulated Drain Canal for Section 3- Dangorayo-Haji Khayr

- ✓ The team didn't identify any Accumulated Drain Canal in this section

## **8.4 HAJI KHAYR - QARDHO DISTRICT ROAD SECTION**

The Haji khayr- Qardho road section stretches 60 km from Haji Khayr district to Qardho district. The Engineers observed on the status of the different components of road including defected Corrugated iron pipe culverts, carriageway ( Potholes ) , Eroded shoulders , Embarkments , stone pitching , overgrown vegetation by using PHA data collection tools.

**The following are the findings and observations of the engineers:**

### **8.4.1 Status of corrugated iron pipe culvert**

The Total number of damaged corrugated iron pipe culverts within Haji khayr – Qardho section is **28 Culverte**.

- 5 trapped by debris and require cleaning ( RM1 and RM2)
- 8 culverts blocked by vegetation ( RM9 )
- 16 Nos head wall gabioins damaged ( RM10)
- 19 Nos of wingwalls gabions damaged (RM10)
- 3 has to be totally replaced ( RM6)
- 1 apron mattress dismantled and stolen ( RM10)
- Identification of cases of trapped debris at inlet of culverts that would indicate incorrect size, inlet or outlet channel inefficiencies.

### **8.4.2 Haji Khayr-Qardho Road Section Map**

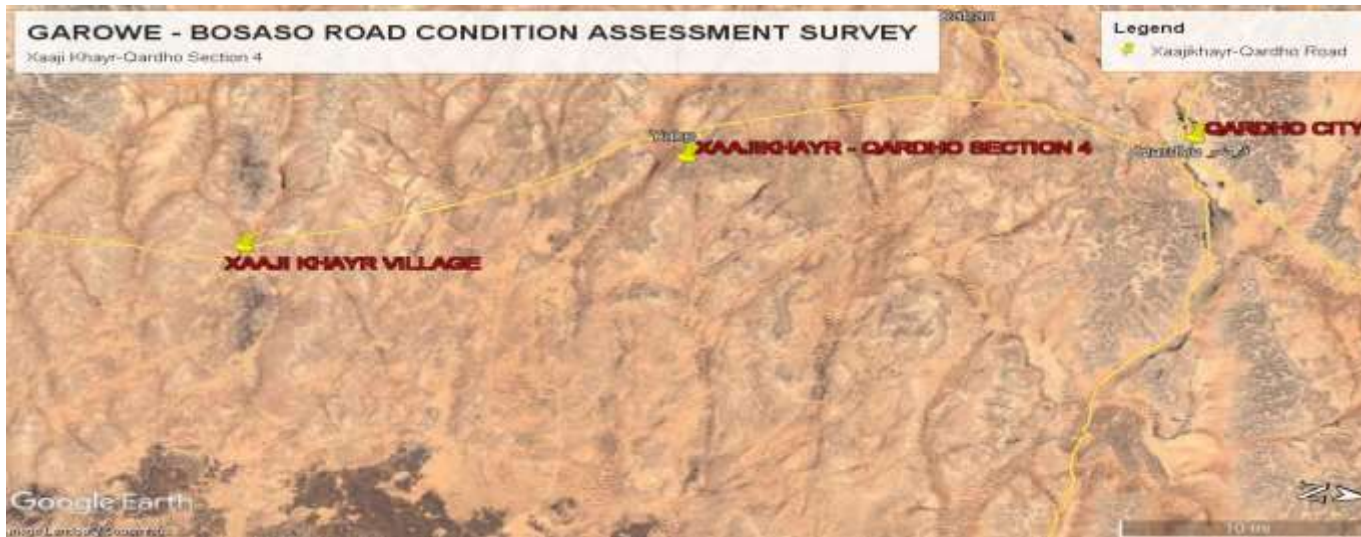


Figure 4: Haji Khayr-Qardho Road Section Map



### 8.4.3 Status of Drainage Structures for Section 4- Haji-Khayr to Qardho

Table 11: Status of Drainage Structures for Section 4- Haji-Khayr to Qardho								
S.NO	Coordinates	Culvert type	Lines	W/D(m)	L(m)	Routine Maintainence (RM10 )	Observations	Proposed Improvement Measures
1	08.99919°N 049.25933°E	Steel pipe	1	D=0.7	14	RM10	Head wall and wing walls gabions of this culvert washed by water for both inlet and outlet.	<i>Reconstructing the damaged headwall and wing wall gabions for both inlet and outlet sides.</i>
2	09.00010°N 049.25870°E	Steel pipe	1	D= 0.7	14	RM6	Blocked totally by soil	<i>Rehabilitation of the Headwall as well as the wing walls for both inlet and outlet sides. Also, the embarkment demands reconstructing.</i>
3	09.00010.°N 049.25870°E	Steel pipe	1	D=0.7	14	RM6	Blocked totally by soil	<i>Rehabilitation of the Headwall as well as the wing walls for both inlet and outlet sides. Also, the embarkment demands reconstructing</i>
4	09.00192°N 049.25774°E	Steel pipe	1	D=0.7	14	RM10, RM1	This culvert head wall and wing walls gabions are shed of shed off (6m <sup>3</sup> of stone are on the outlet side, also the inlet canal is blocked by stones (3m <sup>3</sup> )	<i>Rehabilitation the culvert's headwall and wing walls and cleaning 9m3 of debris stone.</i>
5	09.02867°N 049.24406°E	Trible Steel pipe	1	D=0.7 D=0.7	14	RM10	This steel pipe culvert all the head wall wing walls	<i>Rehabilitation the culvert headwall and wing walls</i>

				D=0.7			gabions are dismantled due to the intensity of the water for both inlet and outlet sides.	<i>for both inlet and outlet.</i>
6	09.06892°N 049.22527°E	Triple Steel pipe	1	D=0.7 D=0.7 D=0.7	14	RM9	There is a vegetation in the outlet only. But, structurally it's stable.	<i>Vegetation cleaning.</i>
7	09.07009°N 049.22446°E	Steel pipe	1	D=0.7	14	RM10	Only the head wall gabions are damaged	<i>Rehabilitation the culvert headwall.</i>
8	08.09245°N 049.21218°E	Steel pipe	1	D=0.7	14	RM9	The inlet and outlet are blocked by vegetations only.	<i>Vegetation cleaning.</i>
9	09.09305°N 049.21198°E	Steel pipe	1	D=1.6	14	RM10	This culvert the head wall, wing wall gabions are dismantled and it needs urgent rehabilitation.	<i>Rehabilitation the culvert headwall and wing walls for both inlet and outlet.</i>
10	09.09305°N 049.21174°E	Steel pipe	1	D=1.2	14	RM10	The head wall and wing walls gabions are shed off.	<i>Reconstructing the culvert headwall and wing walls for both inlet and outlet.</i>
11	09.09391°N 049.21148°E	Steel pipe	1	D=1.2	14	RM10	There is a minor damage in the head wall and wing walls gabions.	<i>Minor Rehabilitation for both headwall and wing walls</i>
12	09.09412°N 049.21137°E	Steel pipe	1	D=1.2	14	RM10 and RM9	This culvert there is a damage in the head wall and wing walls gabion. Also, there is vegetation blockage in the pipe culvert.	<i>Reconstructing the head wall and wing walls gabions, also it needs Vegetation cleaning.</i>
13	09.09434°N 049.21125°E	Steel pipe	1	D=1.2	14	RM9 and RM2	This culvert there is huge blockage in the of vegetation and stones	<i>Cleaning for both vegetation and debris stones.</i>

							which needs to clean up.	
14	09.09505°N 049.21086°E	Steel pipe	1	D=0.7	14	RM9 and RM10	the wing walls gabion are damaged and outlet are closed by vegetations.	<i>Rehabilitation of wing walls gabions and vegetation cleaning at the outlet side.</i>
15	09.10691°N 049.20391°E	Steel pipe	1	D=1.2	14	RM9 and RM10	the wing walls gabion in the outlet side shed off. Also, the canal blocked by vegetations.	<i>Reconstruction the wing walls gabion and the cleaning of vegetation.</i>
16	09.11367°N 049.19975°E	Steel pipe	1	D=1.2	14	RM10	There is a destruction in the wing walls and head wall gabions (it needs reconstruction)	<i>Reconstruction of head wall and wing walls gabions.</i>
17	09.11770°N 049.19727°E	Steel pipe	1	D=0.8	14	RM10	There is a damage in the head wall and wing walls	<i>Rehabilitation of wing walls and head walls</i>
18	09.11877°N 049.19670°E	Steel pipe	1	D=0.8	14	RM10	The wing walls, head wall and apron bed sheet are totally destruct.	<i>Reconstructing new concrete wing walls and headwalls as well as apron bed sheet for both inlet and outlet sides.</i>
19	09.12274°N 049.19447°E	Steel pipe	1	D=0.8	14	RM1 and RM10	the inlet side are closed/blocked by stones also, one wing walls are damaged.	<i>Rehabilitation one wing wall at the inlet side. Also, debris stone cleaning.</i>
20	09.18269°N 049.17464°E	Steel pipe	1	D=0.8	14	RM10	the two wing walls gabions for both inlet and outlet are collapsed.	<i>Reconstruction new wing walls gabion for both inlet and outlet.</i>
21	09.19806°N 049.13413°E	Steel pipe	1	D=1.6	14	RM9 and RM10	The two wing walls and head walls gabions are totally collapsed. Also, in the inlet side there is vegetation which blocked by the canal.	<i>Reconstructing the wing walls and headwall gabions and Vegetation cleaning.</i>



22	09.20082°N 049.13276°E	Steel pipe	1	D=1.6	14	RM10	One head wall and one wing wall gabion are damaged in the inlet and outlet.	<i>Rehabilitation of one headwall and one wing wall gabion for both inlet and outlet sides.</i>
23	09.20452°N 049.13104°E	Steel pipe	1	D=1.6	14	RM6	the two head walls and wing wall gabions are totally collapse. Also, there is a little bit rusting/corrosion	<i>Both of these canals need to replace the damaged culvert pipe section and Gabion box protection and replace to the similar corrugated GI pipe new and install concrete structure for both inlet and outlet ends, clear the inlet/outlet channels and the inside of the culvert repair defects in other section and sealing of rusted spots using mastic asphalt or surface plate welding.</i>
24	09.20694°N 049.12988°E	Steel pipe	1	D=1.2	14	RM2 and RM9	Are totally blocked by vegetation and soil	<i>Soil and Vegetation Cleaning.</i>
25	09.13200°N 049.0719°E	Steel pipe	1	D=?	14	RM2	Totally closed by garbage and rubbish for both inlet and outlet.	<i>Garbage and rubbish cleaning for both inlet and outlet and then investigate if there is any damage or not.</i>
26	09.24515°N 049.11158°E	Steel pipe	1	D=0.8	14	RM10	Both inlet and outlet the head walls and wing walls gabion damaged.	<i>Reconstruction new wing walls and headwall gabions for both inlet and outlet</i>
27	09.25546°N	Steel pipe	1	D=0.8	14	RM10	The two wing walls of	<i>Reconstruction new wing</i>

	049.10743°E						this culvert are totally washed of by water.	<i>walls and headwall gabions for both inlet and outlet</i>
28	09.29246°N 049.09170°E	Steel pipe	1	D=0.8	14	RM10	The two wing walls and head walls are totally shed off.	<i>Reconstruction new wing walls and headwall gabions for both inlet and outlet</i>

### 8.4.4 Photos: Culverts for Section 4- Haji Khayr-Qardho

(CulvertsNo:24)



Lat 9.094832  
 Long 49.210784  
 Photo 57- showing Culvert outlet



Lat 9.144729  
 Long 49.181713  
 Photo 58- showing Culvert outlet



Lat 9.114340  
 Long 49.199204  
 Photo 59- showing Culvert outlet



LAKE ATHABASCA CANADA  
 Latitude 9.093178° Longitude 49.211676°  
 LOCAL TIME: 08:43:38 TUESDAY 03/11/2022  
 GMT: 07:02:50 ALTITUDE: 668 METER



Lat 9.590487  
 Long 49.152295  
 Photo 60- showing Culvert outlet



LAKE ATHABASCA CANADA  
 Latitude 9.000346° Longitude 49.258358°  
 LOCAL TIME: 08:55:59 TUESDAY 03/11/2022 ALTITUDE: 619 METER



LAKE ATHABASCA CANADA  
 Latitude 9.094109° Longitude 49.211004°  
 LOCAL TIME: 08:47:44 TUESDAY 03/11/2022 ALTITUDE: 654 METER



LAKE ATHABASCA CANADA  
 Latitude 9.144729° Longitude 49.181713°  
 LOCAL TIME: 08:44:41 TUESDAY 03/11/2022 ALTITUDE: 633 METER





LAKE ATHABASCA CANADA  
Latitude 9.068928° Longitude 49.224897°  
LOCAL TIME: 0MT 06:52:17 TUESDAY 03/07/2012 ALTITUDE 624 METER



LAKE ATHABASCA CANADA  
Latitude 9.071737° Longitude 49.223134°  
LOCAL TIME: 0MT 06:52:23 TUESDAY 03/07/2012 ALTITUDE 622 METER



LAKE ATHABASCA CANADA  
Latitude 9.093745° Longitude 49.211395°  
LOCAL TIME: 0MT 07:49:43 TUESDAY 03/07/2012 ALTITUDE 624 METER



LAKE ATHABASCA CANADA  
Latitude 9.094832° Longitude 49.210784°  
LOCAL TIME: 0MT 08:04:26 TUESDAY 03/07/2012 ALTITUDE 621 METER



LAKE ATHABASCA CANADA  
Latitude 9.094611° Longitude 49.210911°  
LOCAL TIME: 0MT 08:04:57 TUESDAY 03/07/2012 ALTITUDE 623 METER



LAKE ATHABASCA CANADA  
Latitude 9.094832° Longitude 49.210784°  
LOCAL TIME: 0MT 08:04:26 TUESDAY 03/07/2012 ALTITUDE 621 METER



LAKE ATHABASCA CANADA  
Latitude 9.114340° Longitude 49.199204°  
LOCAL TIME: 0MT 08:17:47 TUESDAY 03/07/2012 ALTITUDE 625 METER



LAKE ATHABASCA CANADA  
Latitude 9.123429° Longitude 49.193863°  
LOCAL TIME: 0MT 08:33:58 TUESDAY 03/07/2012 ALTITUDE 626 METER



LAKE ATHABASCA CANADA  
Latitude 9.119396° Longitude 49.196025°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 671 METERS



LAKE ATHABASCA CANADA  
Latitude 9.189339° Longitude 49.146913°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 674 METERS



LAKE ATHABASCA CANADA  
Latitude 9.068928° Longitude 49.224897°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 661 METERS



LAKE ATHABASCA CANADA  
Latitude 9.094109° Longitude 49.211004°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 674 METERS



LAKE ATHABASCA CANADA  
Latitude 9.000346° Longitude 49.258358°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 676 METERS



LAKE ATHABASCA CANADA  
Latitude 9.118415° Longitude 49.196753°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 671 METERS



LAKE ATHABASCA CANADA  
Latitude 9.093745° Longitude 49.211395°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 674 METERS



LAKE ATHABASCA CANADA  
Latitude 9.071737° Longitude 49.223134°  
LOCAL 111636 DAT 162833 TUESDAY 03/11/2017 ALTITUDE 732 METERS



### 8.4.5 Shoulder Erosion for Section 4- Haji Khayr-Qardho

✓ The team observed on this Section 7.380 km Defected Shoulder

Table 12: Shoulder Erosion for Section 4- Haji Khayr-Qardho									
No.	Start Coordinates		End coordinates		L	W	D	Shoulder Defects (RM4)	Proposed Improvement Measures
117	9.00526° N	49.25570° E	9.0099 9°N	49.25293°E	300	1.2	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
118	9.00526° N	49.25570° E	9.0099 9°N	49.25293°E	380	1.2	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
119	9.00999° N	49.25293° E	9.0859 3°N	49.21613°E	1200	0.8	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
120	9.00999° N	49.25293° E	9.0859 3°N	49.21613°E	1120	0.6	0.1	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
121	9.09041° N	49.21337° E	9.1418 5°N	49.18393°E	370	0.7	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
122	9.09041° N	49.21337° E	9.1418 5°N	49.18393°E	290	0.6	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
123	9.14185° N	49.18393° E	9.2231 3°N	49.12207°E	630	0.8	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
124	9.14185° N	49.18393° E	9.2231 3°N	49.12207°E	570	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
125	9.23896° N	49.11448° E	9.3021 2°N	49.08781°E	720	0.7	0.0 4	Shoulder erosion	Construction of shoulder pavement and applying single

									surface dressing
126	9.23896° N	49.11448° E	9.3021 2°N	49.08781°E	450	0.4	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
127	9.30210° N	49.08780° E	9.4376 9°N	49.07091°E	360	0.7	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
128	9.30210° N	49.08780° E	9.4376 9°N	49.07091°E	210	0.4	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
129	9.54669° N	49.11809° E	9.7484 2°N	49.19561°E	780	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing

**8.4.6 Photos: Shoulder erosion for Section 4- Haji Khayr-Qardho**



**SHOULDER EROSION (RM4)  
@ HAJI KHAYR-QARDHO SECTION**



**SHOULDER EROSION (RM4)  
@ HAJI KHAYR-QARDHO SECTION**



**SHOULDER EROSION (RM4)  
@ HAJI KHAYR-QARDHO SECTION**



**SHOULDER EROSION (RM4)  
@ HAJI KHAYR-QARDHO SECTION**



**SHOULDER EROSION (RM4)  
@ HAJI KHAYR-QARDHO SECTION**



**SHOULDER EROSION (RM4)  
@ HAJI KHAYR-QARDHO SECTION**



#### 8.4.7 Status of Washed Embankment for Section 4- Haji Khayr-Qardho

- ✓ The length of the washed Embankments is 1.436 km
- ✓ The team identified of Embankment erosion that indicates frequent overtopping.

**Table 13: Status of Washed Embankment for Section 4- Haji Khayr-Qardho**

<b>N O</b>	<b>START COORDINATES</b>		<b>END COORDINATES</b>		<b>LENGT H</b>	<b>AVERAGE DEPTH</b>	<b>DEFECTS (RM5)</b>	<b>Proposed improvement measure</b>
11	8.93115 °N	49.27156°E	8.9315 6°N	49.27159°E	48	0.5	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
12	8.93156 °N	49.27159°E	8.9321 6°N	49.27167°E	55	2.1	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
13	8.93332 °N	49.27187°E	8.9354 4°N	49.27213°E	230	1.7	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
14	8.99899 °N	49.25443°E	9.0022 9°N	49.25746°E	430	1.8	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
15	9.02867 °N	49.24406°E	9.0321 0°N	49.24270°E	455	1	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
16	9.06819 °N	49.22559°E	9.0684 6°N	49.22542°E	43	0.8	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
17	9.06987 °N	49.22472°E	9.0717 9°N	49.22364°E	175	0.9	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.

**8.4.8 Photos: Washed Embankment for Section 4- Haji Khayr-Qardho**



#### 8.4.9 Status of Overgrown Vegetation for Section 4- Haji Khayr-Qardho

✓ The length of overgrown vegetation is 5.950 km

Table 14: Status of Overgrown Vegetation for Section 4- Haji Khayr-Qardho							
STATUS OF VEGETATION							
NO	START COORDINATES		END COORDINATES		LENGTH	DEFECT (RM9)	PRPOSED IMPROVEMENT MEASURE
1	9.25546°N	49.10743°E	9.29246°N	49.09167°E	2150	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
2	9.30298°N	49.10745°E	9.35423°N	49.06806°E	2500	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
3	9.36719°N	49.06746°E	9.38774°N	49.06670°E	3000	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.



**8.4.10 Photos: Overgrown Vegetation for Section 4- Haji Khayr-Qardho**



#### 8.4.11 Status of Stone Pitching for Section 4- Haji Khayr-Gardo

✓ The length of the eroded stone pitching is 32.50m

Table 15: Status of Stone Pitching for Section 4- Haji Khayr-Gardo						
NO	COORDINATES		LENGTH	AVERAGE WIDTH	DEFECTS (RM5)	PRPOSED IMPROVEMENT MEASURE
1	9.06890°N	49.22522°E	7	0.7	3 years before there were heavy rain falls in puntland region and generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
2	9.06987°N	49.22472°E	9	2.5	3 years before there were heavy rain falls in puntland region and generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
3	9.20296°N	49.13177°E	6.6	8	3 years before there were heavy rain falls in puntland region and generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
4	9.62168°N	49.17414°E	3.2	3.1	3 years before there were heavy rain falls in puntland region and generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
5	9.62169°N	49.17416°E	2.9	3.4	3 years before there were heavy rain falls in puntland region and generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired
6	9.62170°N	49.17418°E	3.8	1.2	3 years before there were heavy rain falls in puntland region and generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired



**8.4.12 Photos: of Stone Pitching for Section 4- Haji Khayr-Qardho**



**Stone pitching (RM5)  
@ Haji khayr-Gardo Section**



**Stone pitching (RM5)  
@ Haji khayr-Gardo Section**



**Stone pitching (RM5)  
@ Haji khayr-Gardo Section**



**Stone pitching (RM5)  
@ Haji khayr-Gardo Section**



**Stone pitching (RM5)  
@ Haji khayr-Gardo Section**



**Stone pitching (RM5)  
@ Haji khayr-Gardo Section**

**8.4.13 Accumulated Drain Canal for Section 4- Haji Khayr-Qardho**

- ✓ The team didn't identify any Accumulated Drain Canal in this section

**8.4.14 Potholes for Section 4- Haji Khayr-Qardho**

- ✓ The team didn't identify any Potholes in this



## **8.5 QARDHO- WAACIYE DISTRICT ROAD SECTION**

The Qardho -Waaciye District road section stretches 70km fromHaji Khayr district to Qardho district. The Engineers observed on the status of the different componentsof road such as defected Corrugated iron pipe culverts , carriageway ( Potholes ) , Eroded shoulders , Embarkments , stone pitching , overgrown vegetation by using PHA data collection tools.

**The following are the findings and observations of the engineers:**

### **8.5.1 Status of corrugated iron pipe culvert**

The Total number of damaged corrugated iron pipe culverts within Haji khayr – Qardho section is 14 culverts.

- 4 trapped by debris and Soil and require cleaning (RM1 and RM2)
- 4 culverts blocked by vegetation (RM9)
- 8 Nos. head wall gabions damaged ( RM10)
- 12 Nos. wing wall gabions are damaged ( RM10)
- Identification of cases of trapped debris at inlet of culverts that would indicate incorrect size, inlet or outlet channel inefficiencies.

### **8.5.2 Qardho -Waaciye Road Section Map**

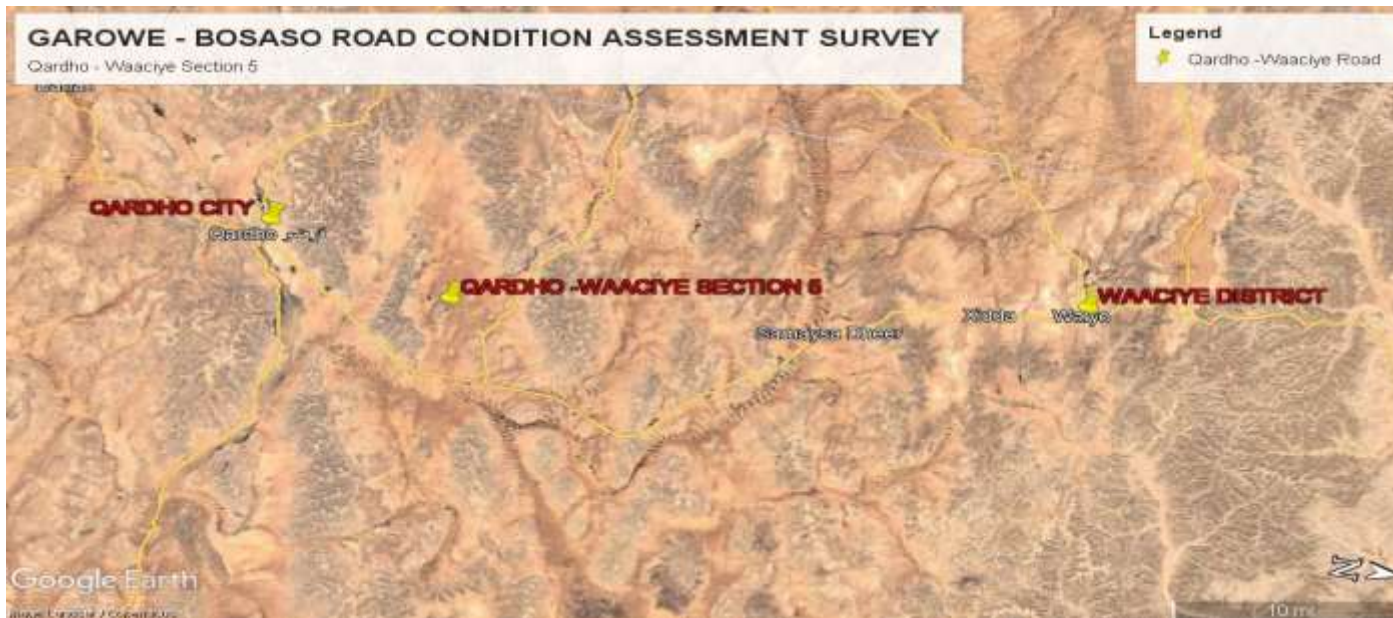


Figure 5: Qardho -Waaciye Road Section Map.

### 8.5.3 Status of Drainage Structures for Section 5- Qardho to Waaciye

Table 16: Status of Drainage Structures for Section 5- Qardho to Waaciye								
S.NO	Coordinates	Culvert type	Lines	W/D(m)	L(m)	Routine Maintainence (RM10 )	Observations	Proposed Improvement Measures
1	09.55466°N 049.12433°E	Steel pipe	1	D=1.2	14	RM10	The two wing walls and head walls gabions are damaged for both inlet and outlet.	<i>Renovation wing walls and headwall gabions for both inlet and outlet</i>
2	09.57402°N 049.14006°E	Steel pipe	1	D=0.8	14	RM10	The two wing and head walls gabions are Dismantled	<i>Rehabilitation of wing walls and headwall gabions for both inlet and outlet</i>
3	09.59013°N 049.15282°E	Steel pipe	1	D <sub>1</sub> =0.8 D <sub>2</sub> =0.8 D <sub>3</sub> =1.2	14	RM2 and RM10	The wing walls gabions fragmented also there is a blockage of stones (6m <sup>3</sup> ).	<i>Rehabilitation of wing walls and headwall gabions for both inlet and outlet. Also, it needs Debris stone cleaning.</i>
4	09.59021°N 049.15289°E	Steel pipe	1	D=0.8	14	RM2 and RM10	The outlet side of the culvert there is blockage of 3m <sup>3</sup> of stones and the wing wall gabions fragmented.	<i>Debris stone cleaning as well as rehabilitation of wing wall gabions.</i>
5	09.59036°N 049.15302°E	Steel pipe	1	D=0.8	14	RM2 and RM10	One side wing wall are damaged also there is a blockage in the outlet side	<i>Rehabilitation of wing walls and removing debris stone and vegetation.</i>
6	09.62584°N 049.17443°E	Steel pipe	1	D=0.8	14	RM10	Both inlet and outlet wing wall gabions are fragmented as well as head walls gabion shed off	<i>Reconstructing of wing wall and head wall gabions for both inlet and outlet.</i>

7	09.65822°N 049.17509°E	Steel pipe	1	D=0.8	14	RM10	The head wall and wing wall gabions are washed of by water as well as the embankment.	<i>Reconstructing of wing walls and the embankment.</i>
8	09.68069°N 049.17550°E	Steel pipe	1	D=0.8	16	RM9and RM10	This culvert there is vegetation as well as the head wall and wing walls gabions are damaged	<i>Rehabilitation of wing walls, headwall and removing debris stone and vegetation.</i>
9	09.71870°N 049.18060°E	Steel pipe	1	D=0.8	16	RM10	Both wing walls and head walls gabions are fragmented	<i>Rehabilitation of wing walls and headwalls</i>
10	09.74282°N 049.19296°E	Steel pipe	1	D=1.2	16	RM9and RM10	The wing walls and head walls gabions are broken and fragmented. Also, for both inlet and outlet there is vegetation.	<i>Vegetation cleaning as well as wing walls and headwall rehabilitation.</i>
11	09.75613°N 049.19804°E	Steel pipe	1	D=0.8	16	RM2 and RM10	This culvert accumulated/filled by soil and stones. Also, the wing wall gabions shows damage.	<i>Cleaning of Soil and debris stone and Rehabilitation of wing walls.</i>
12	09.77269°N 049.18861°E	Steel pipe	1	D=0.8	16	RM9	There is a vegetation barrier in the culvert canal which needs to clean up.	<i>Vegetation Cleaning.</i>
13	09.77414°N 049.18642°E	Steel pipe	1	D=0.8	16	RM9	There is a vegetation barrier in the culvert canal which needs to clean up.	<i>Vegetation Cleaning.</i>
14	09.84019°N 049.12346°E	Steel pipe	1	Box	16	RM10	This culvert need stone bitching/riprap rehabilitation for a dimension ( l=5m. w= 3.9m)	<i>Stone bitching or riprap rehabilitation for a dimension of (L=5m, W=3.9m)</i>



## 8.5.4 Photos: Culverts for Section 5- Qardho-Waaciye

( Culverts No:13 nos.)



Lat 9.590488  
Long 49.152177  
Photo 61- showing Culvert outlet



Lat 9.207592  
Long 49.129099  
Photo 62- showing Culvert outlet



Lat 9.201505  
Long 49.132184  
Photo 63- showing Culvert outlet



Lat 9.750158  
Long 49.195473  
Photo 70- showing Culvert outlet



Lat 9.255913  
Long 49.106614  
Photo 64- showing Culvert outlet



Lat 9.590487  
Long 49.152295  
Photo 65- showing Culvert outlet



Lat 9.198716  
Long 49.133525  
Photo 66- showing Culvert outlet



Lat 9.773629  
Long 49.188126  
Photo 71- showing Culvert outlet



Lat 9.590824  
Long 49.152363  
Photo 67- showing Culvert outlet



Lat 9.658915  
Long 49.174339  
Photo 68- showing Culvert outlet



Lat 10.497692  
Long 49.074262  
Photo 69- showing Culvert outlet



Lat 10.497692  
Long 49.074262  
Photo 72- showing Culvert outlet

### 8.5.5 Shoulder Erosion for Section 5- Qardho-Waaciye

✓ The team observed on this Section 2.988 km Defected Shoulder

Table 17: Shoulder Erosion for Section 5- Qardho-Waaciye

No.	Start Coordinates		End coordinates		L	W	D	Shoulder Defects (RM4)	Proposed Improvement Measures
130	9.74980° N	49.19626° E	9.8008 4°N	49.15436°E	435	0.5	0.0 4	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
131	9.74980° N	49.19626° E	9.8008 4°N	49.15436°E	325	0.4	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
132	9.80084° N	49.19616° E	9.8577 1°N	49.09621°E	346	0.5	0.0 5	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
133	9.80084° N	49.19616° E	9.8577 1°N	49.09621°E	212	0.4	0.0 4	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
134	9.85771° N	49.09621° E	9.9938 3°N	49.04909°E	930	0.5	0.0 3	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
135	9.85771° N	49.09621° E	9.9938 3°N	49.04909°E	740	0.5	0.0 4	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing



**8.5.6 Photos: Shoulder erosion for Section 5- Qardho-Waaciye**



**SHOULDER EROSION (RM4)  
@ GARDO-WACIYE SECTION**



**SHOULDER EROSION (RM4)  
@ GARDO-WACIYE SECTION**



**SHOULDER EROSION (RM4)  
@ GARDO-WACIYE SECTION**



**SHOULDER EROSION (RM4)  
@ GARDO-WACIYE SECTION**



**SHOULDER EROSION (RM4)  
@ GARDO-WACIYE SECTION**



**SHOULDER EROSION (RM4)  
@ GARDO-WACIYE SECTION**

### 8.5.7 Status of Washed Embankment for Section 5- Qardho -Waaciye

✓ The length of the washed Embankments is 1.024 km

Table 18: Status of Washed Embankment for Section 5- Qardho –Waaciye

NO	START COORDINATES		END COORDINATES		LENGTH	AVERAGE DEPTH	DEFECTS (RM5)	Proposed improvement measure
18	9.62372° N	49.17437° E	9.62676° N	49.17446° E	336	0.8	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
19	9.65769° N	49.17506° E	9.65957° N	49.17509° E	315	0.95	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
20	9.68882° N	49.17563° E	9.69058° N	49.17567° E	211	0.9	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
21	9.83440° N	49.13054° E	9.83542° N	49.12991° E	162	0.9	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.

**8.5.8 Photos: Washed Embankment for Section 5- Qardho –Waaciye**



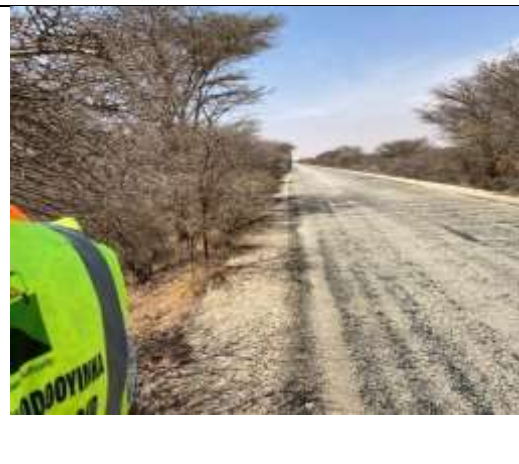


### 8.5.9 Status of Overgrown Vegetation for Section 5- Qardho-Waaciye

✓ The length of overgrown vegetation is 10.350 km

Table 19: Status of Overgrown Vegetation for Section 5- Qardho-Waaciye							
NO	START COORDINATES		END COORDINATES		LENGTH	DEFECT (RM9)	PRPOSED IMPROVEMENT MEASURE
	9.54669°N	49.11809°E	9.74842°N	49.19561°E	4000	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
	9.80084°N	49.19626°E	9.80715°N	49.14864°E	1750	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
	9.80084°N	49.19626°E	9.80715°N	49.14864°E	1800	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
	9.83887°N	49.12569°E	9.85771°N	49.09621°E	1200	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
	9.83887°N	49.12569°E	9.85771°N	49.09621°E	800	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
	9.89513°N	49.07049°E	9.89736°N	49.06576°E	800	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.

**8.5.10 Photos: Overgrown Vegetation for Section 5- Qardho –Waaciye**





**8.5.11 Status of Potholes for Section 5- Qardho –Waaciye**

- ✓ The number of small size potholes are 2106 pcs
- ✓ The number of small size potholes are 45 pcs
- ✓ The number of small size potholes are 11 pcs

Table 20: Status of Potholes for Section 5- Qardho –Waaciye						
Coordinates		Pothole sizes				
Start	End	Small (0.5x0.5 x0.04)	Medium (0.8x1.0 x0.05)	Large (1.2x1.8 x0.05)	Defect (RM7)	Solution
09.54669 049.11809	10.01777 049.04280	2106	45	11	The party of the carriage way was devastated by rains and heavy traffic activity and then called Potholes	The repair works involves cutting edges around the potholes and excavation down to the sub grade and then filling and compacting for approval material applying double surface Dressing

**8.5.12 Photos: Status of Potholes for Section 5- Qardho –Waaciye**



**8.5.13 Status of Stone Pitching for Section 5- Qardho –Waaciye**

✓ The length of the eroded stone pitching is 5m

Table 21 Status of Stone Pitching for Section 5- Qardho –Waaciye						
NO	COORDINATES		LENGTH	AVERAGE WIDTH	DEFECTS (RM5)	PRPOSED IMPROVEMENT MEASURE
17	9.84019°N	49.12346°E	5	3.9	3 years before there were heavy rain falls in puntland region and generally defected many spots of the road specially road embankment with stone pitching due to in adequate drainage capacity	The defected stone pitching on the embankment is essential for protection against erosion of the embankment and has to be repaired



**8.5.14 Photos: Stone Pitching for Section 5- Qardho –Waaciye**



## **8.6 WAACIYE - CARMO DISTRICT ROAD SECTION**

The Waaciye – Carmo District road section stretches 70km from Waaciye to Carmo district. The Engineers observed on the status of the different components of road such as defected Corrugated iron pipe culverts , carriageway ( Potholes ) , Eroded shoulders , Embankments , stone pitching , overgrown vegetation by using PHA data collection tools.

**The following are the findings and observations of the engineers:**

### **8.6.1 Status for corrugated iron pipe culvert**

The Total number of damaged corrugated iron pipe culverts within Waaciye to Carmo districts section is 2 culverts.

- 1 No. of head wall gabion is damaged ( RM10)
- 1 No. of wing wall damaged ( RM10)
- 1 has to be totally replaced ( RM6)

### **8.6.2 Waaciye-Carmo Road Section Map**

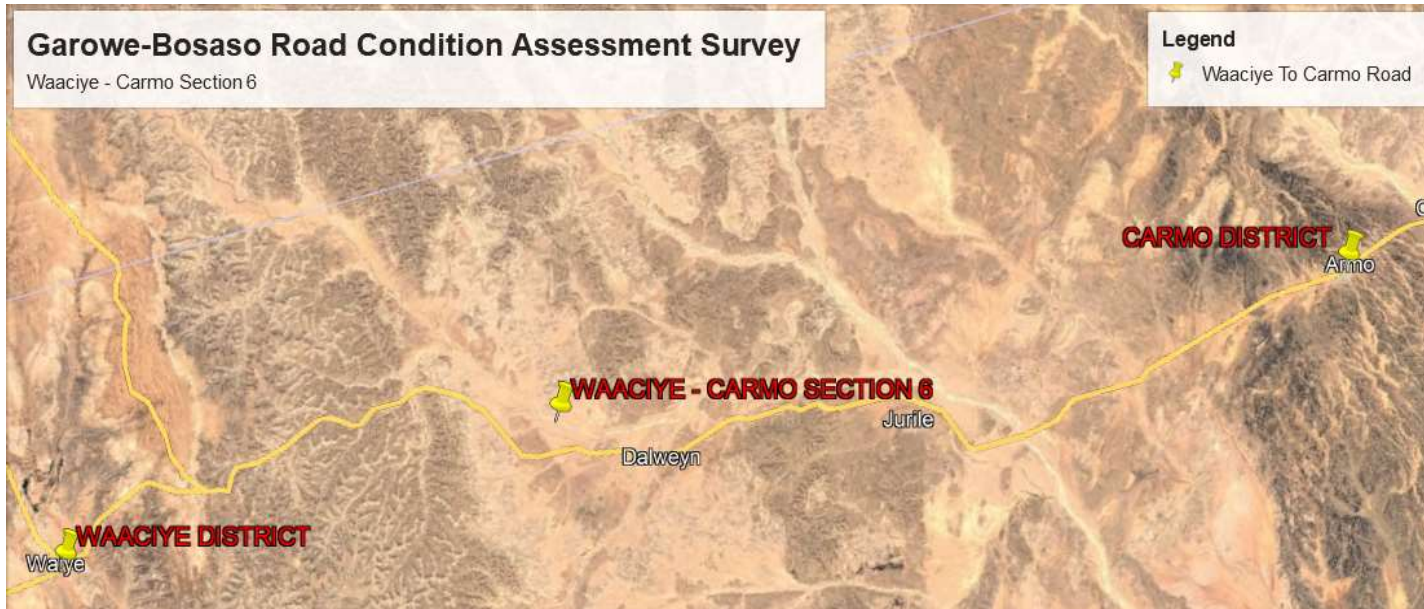


Figure 6: Waaciye-Carmo Road Section Map



### 8.6.3 Status of Drainage Structures for Section 6- Waciye-Carmo

Table 22: Status of Drainage Structures for Section 6: Waciye to carmo								
1	10.82280°N 049.24655°E	Steel pipe	1	D=1.6 D=1.6	12	RM10	This culvert both wing walls and head walls gabions are fragmented and destruction so it needs total replacement.	<i>Constructing new concrete box culver.</i>
2	10.84554°N 049.26079°E	Steel pipe	1	D=?	12	RM6	This culvert totally destroyed by water and the local people buried it by soil.	<i>Constructing new concrete pipe culverts or box culver</i>

### 8.6.4 Photos: Culverts for Section 6- Waciye-Carmo

( Culverts No:2 nos.)



Lat 9.590487  
Long 49.152295



Lat 9.198716  
Long 49.133525

### 8.6.5 Shoulder Erosion for Section 6- Waaciye-Carmo

- Team observed in this Section 4.750 km Defected Shoulder

Table 23: Shoulder Erosion for Section 6- Waaciye-Carmo

No.	Start Coordinates		End coordinates		L	W	D	Shoulder Defects (RM4)	Proposed Improvement Measures
136	10.01777° N	49.04280° E	10.076 83°N	49.02885°E	720	0.7	0.03	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
137	10.01777° N	49.04280° E	10.076 83°N	49.02885°E	515	0.6	0.03	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
138	10.08740° N	49.03110° E	10.391 28°N	49.08224°E	1130	0.5	0.04	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
139	10.08740° N	49.03110° E	10.391 28°N	49.08224°E	460	0.4	0.05	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
140	10.42690° N	49.09307° E	10.595 74°N	49.05083°E	1140	0.7	0.04	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
141	10.42690° N	49.09307° E	10.595 74°N	49.05083°E	785	0.7	0.04	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing

**8.6.6 Photos: Shoulder erosion for Section 6- Waaciye-Carmo**



**SHOULDER EROSION (RM4)  
@WACIYE-ARMO SECTION**



**SHOULDER EROSION (RM4)  
@WACIYE-ARMO SECTION**



**SHOULDER EROSION (RM4)  
@WACIYE-ARMO SECTION**



**SHOULDER EROSION (RM4)  
@WACIYE-ARMO SECTION**



**SHOULDER EROSION (RM4)  
@WACIYE-ARMO SECTION**



**SHOULDER EROSION (RM4)  
@WACIYE-ARMO SECTION**

### 8.6.7 Status of Washed Embankment for Section 6- Waaciye-Carmo

✓ The length of the washed Embankments is 606m

Table 24: Status of Washed Embankment for Section 6- Waaciye-Carmo								
NO	START COORDINATES		END COORDINATES		LENGTH	AVERAG E DEPTH	DEFECTS (RM5)	Proposed improvement measure
22	10.32543° N	49.05743° E	10.32640 °N	49.05743° E	110	1.1	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
23	10.39115° N	49.08203° E	10.39177 °N	49.08393° E	56	1.7	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
24	10.42031° N	49.09283° E	10.42804 °N	49.09256° E	190	0.7	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
25	10.49691° N	49.07505° E	10.49930 °N	49.07430° E	250	1.2	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.



**8.6.8 Photos: Washed Embankment for Section 6- Waaciye-Carmo**





### 8.6.9 Status of Overgrown Vegetation for Section 6- Waaciye-Carmo

✓ The length of overgrown vegetation is 3.880km

Table 25: Status of Overgrown Vegetation for Section 6- Waaciye-Carmo							
NO	START COORDINATES		END COORDINATES		LENGT H	DEFECT (RM9)	PRPOSED IMPROVEMENT MEASURE
	10.03651°N	49.02891°E	10.07683°N	49.02885°E	2800	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.
	10.03655°N	49.02895°E	10.07686°N	49.02889°E	1000	branches are reaching over the carriage way narrowing the traffic lines in very dangerous way	Removeall thorn bush and trees that are overgrowing on the shoulders, embankmentand the side drains.

**8.6.10 Photos: Overgrown Vegetation for Section 6- Waaciye-Carmo**



### 8.6.11 Status of Drianae for Section 6- Waaciye-Carmo

✓ The length of Accumulated drain canals is 960m

Table 26: Status of Drianae for Section 6- Waaciye-Carmo								
NO	START COORDINATES		END COORDINATES		LENGT H	AVER AGE DEPTH	DEFECTS (RM3)	PROPOSED IMPROVEMENT MEASURE
1	10.09515 °N	49.02357 °E	10.09360° N	49.02451 °E	60	0.5	the defect of the side drain canal is a broken party of the concrete as well as the debris materials accumulated in the party of the side drain canals .	major structure of dire drain canals along this section of the required minor repair works and removing of accumulated debris materials in party of the side drain canals.
2	10.09060 °N	49.03041 °E	10.08871° N	49.03188 °E	30 0	0.5	the defect of the side drain canal is a broken party of the concrete as well as the debris materials accumulated in the party of the side drain canals .	major structure of dire drain canals along this section of the required minor repair works and removing of accumulated debris materials in party of the side drain canals.
3	10.03176 °N	49.03207 °E	10.02991° N	49.03475 °E	60 0	0.5	the defect of the side drain canal is a broken party of the concrete as well as the debris materials accumulated in the party of the side drain canals .	major structure of dire drain canals along this section of the required minor repair works and removing of accumulated debris materials in party of the side drain canals.



8.6.12 Photos: Drainage for Section 6- Waaciye-Carmo



### 8.6.13 Status of Potholes for Section 6- Waaciye-Carmo

- ✓ The number of small size potholes are 259 pcs
- ✓ The number of small size potholes are 9 pcs
- ✓ The number of small size potholes are 20 pcs

Table 27: Status of Potholes for Section 6- Waaciye-Carmo

Coordinates		Pothole sizes			Defect (RM7)	Solution
Start	End	Small (0.5x0.5 x0.04)	Medium (0.8x1.0 x0.05)	Large (1.2x1.8 x0.05)		
10.01777 049.0428 0	10.59574 049.05083	259	9	20	The party of the carriage way was defected by rains and heavy traffic activity and then called Potholes	The repair works involves cutting edges around the potholes and excavation down to the sub grade and then filling and compacting for approval material applying double surface Dressing



#### 8.6.14 Photos: Potholes for Section 6- Waaciye-Carmo



#### 8.6.15 Damaged stone pitching for Section 6- Waaciye-Carmo

- The team didn't identify any damaged stone pitching in this section

## **8.7 CARMO - BOSASO DISTRICT ROAD SECTION**

The Carmo - Bosaso District road section stretches 100km from Armo to Bosaso district. The Engineers observed on the status of the different components of road including defected Corrugated iron pipe culverts, carriageway ( Potholes ) , Eroded shoulders , Embankments , stone pitching , overgrown vegetation by using PHA data collection tools.

**The following are the findings and observations of the PHA engineers:**

### **8.7.1 Status for corrugated iron pipe culvert**






- The team identified re construction of 52 culverts

### **8.7.2 Carmo-Bosaso Road Section Map**



Figure 7: Carmo-Bosaso Road Section Map

**Project Name :Bosaso – Kalabayr Reconstruction and Rehabilitation of Culverts – Phase 2**


No	GPS coordinates	Diameter (m)	Length (m)	Number of Culverts	Condition	Photo
1	Lat 11.218555 <sup>0</sup> Long 49.194553 <sup>0</sup>	0.8	18	Single	Rusted /Replacement required	
2	Lat 11.202782 <sup>0</sup> Long 49.179419 <sup>0</sup>	1.00	17	Single	Rusted /Replacement required	
3	Lat 11.201744 <sup>0</sup> Long 49.177764 <sup>0</sup>	1.00	18	Single	Rusted /Replacement required	
4	Lat 11. 187477 <sup>0</sup> Long 49.165029 <sup>0</sup>	0.8	14	Single	Rusted /Replacement required	
5	Lat 11. 187155 <sup>0</sup> Long 49.164634 <sup>0</sup>	0.8	15	Single	Rusted /Replacement required	







6	Lat 11.183784 <sup>0</sup> Long 49.160712 <sup>0</sup>	0.8	17	Single	Rusted /Replacement required	
7	Lat 11.174107 <sup>0</sup> Long 49.154449 <sup>0</sup>	1.00	20	Single	Rusted /Replacement required	
8	Lat 11.165322 <sup>0</sup> Long 49.153662 <sup>0</sup>	0.8	13	Single	Rusted /Replacement required	
9	Lat 11.165322 <sup>0</sup> Long 49.153662 <sup>0</sup>	0.8	14	Single	Rusted /Replacement required	
10	Lat 11.155684 <sup>0</sup> Long 49.152682 <sup>0</sup>	1.5	20	Single	Rusted /Replacement required	

11	Lat 11.138457 <sup>0</sup> Long 49.157420 <sup>0</sup>	1.5	14	Single	Rusted /Replacement required	
12	Lat 11.147617 <sup>0</sup> Long 49.155226 <sup>0</sup>	0.8	14	Single	Rusted /Replacement required	
13	Lat 11.141988 <sup>0</sup> Long 49.157493 <sup>0</sup>	0.8	17	Single	Rusted /Replacement required	
14	Lat 11.117972 <sup>0</sup> Long 49.155034 <sup>0</sup>	1.5	24	Single	Rusted /Replacement required	



15	Lat 11.116610 <sup>0</sup> Long 49.155226 <sup>0</sup>	1.5	24	Single	Rusted /Replacement required	
16	Lat 11.101578 <sup>0</sup> Long 49.168509 <sup>0</sup>	0.8	25	Single	Rusted /Replacement required	
17	Lat 11.094085 <sup>0</sup> Long 49.179827 <sup>0</sup>	1.5	29	Single	Rusted /Replacement required	
18	Lat 11.092023 <sup>0</sup> Long 49.183326 <sup>0</sup>	1.5	28	Single	Rusted /Replacement required	
19	Lat 11.088752 <sup>0</sup> Long 49.189722 <sup>0</sup>	1.5	42	Single	Rusted /Replacement required	

20	Lat 11.088593 <sup>0</sup> Long 49.189972 <sup>0</sup>	1.5	27	Single	Rusted /Replacement required	
21	Lat 11.067234 <sup>0</sup> Long 49.187004 <sup>0</sup>	1.5	23	Single	Rusted /Replacement required	
22	Lat 11.067219 <sup>0</sup> Long 49.187214 <sup>0</sup>	1.5	42	Single	Rusted /Replacement required	
23	Lat 11.060406 <sup>0</sup> Long 49.186922 <sup>0</sup>	1	27	Single	Rusted /Replacement required	






24	Lat 11.110119 <sup>0</sup> Long 49.161302 <sup>0</sup>	0.8	14	Single	Rusted /Replacement required	
25	Lat 11.056295 <sup>0</sup> Long 49.188245 <sup>0</sup>	1.5	23	Single	Rusted /Replacement required	
26	Lat 11.039000 <sup>0</sup> Long 49.188840 <sup>0</sup>	1	27	Single	Rusted /Replacement required	
27	Lat 11.028780 <sup>0</sup> Long 49.188186 <sup>0</sup>	0.8	14	Single	Rusted /Replacement required	




28	Lat 11.021661 <sup>0</sup> Long 49.194068 <sup>0</sup>	1	14	Single	Rusted /Replacement required	
29	Lat 11.024163 <sup>0</sup> Long 49.190039 <sup>0</sup>	1	17	Single	Rusted /Replacement required	
30	Lat 11.021661 <sup>0</sup> Long 49.194068 <sup>0</sup>	1	22	Single	Rusted /Replacement required	
31	Lat 11.017915 <sup>0</sup> Long 49.195206 <sup>0</sup>	0.8	22	Single	Rusted /Replacement required	
32	Lat 11.015793 <sup>0</sup> Long 49.196160 <sup>0</sup>	1	17	Single	Rusted /Replacement required	

33	Lat 11.015707 <sup>0</sup> Long 49.196440 <sup>0</sup>	1.5	27	Single	Rusted /Replacement required	
34	Lat 11.015258 <sup>0</sup> Long 49.197365 <sup>0</sup>	1	22	Single	Rusted /Replacement required	
35	Lat 11.015190 <sup>0</sup> Long 49.197647 <sup>0</sup>	0.8	22	Single	Rusted /Replacement required	
36	Lat 11.007604 <sup>0</sup> Long 49.204132 <sup>0</sup>	1.5	14	Single	Rusted /Replacement required	
37	Lat 11.007620 <sup>0</sup> Long 49.204145 <sup>0</sup>	1	14	Single	Rusted /Replacement required	



38	Lat 11.007060 <sup>0</sup> Long 49.204460 <sup>0</sup>	1.5	20	Single	Rusted /Replacement required	
39	Lat 11.505865 <sup>0</sup> Long 49.204945 <sup>0</sup>	1.5	20	Single	Rusted /Replacement required	
40	Lat 11.002918 <sup>0</sup> Long 49.206323 <sup>0</sup>	1	14	Single	Rusted /Replacement required	
41	Lat 11.002993 <sup>0</sup> Long 49.206447 <sup>0</sup>	1	17	Single	Rusted /Replacement required	
42	Lat 10.991327 <sup>0</sup> Long 49.207066 <sup>0</sup>	1	29	Single	Rusted /Replacement required	

43	Lat 10.993646 <sup>0</sup> Long 49.207990 <sup>0</sup>	1	14	Single	Rusted /Replacement required	
44	Lat 10.972003 <sup>0</sup> Long 49.216392 <sup>0</sup>	0.8	16	Single	Rusted /Replacement required	
45	Lat 10.965082 <sup>0</sup> Long 49.223432 <sup>0</sup>	1.5	16	Single	Rusted /Replacement required	
46	Lat 10.963878 <sup>0</sup> Long 49.223478 <sup>0</sup>	1.5	17	Single	Rusted /Replacement required	
47	Lat 10.962426 <sup>0</sup> Long 49.223055 <sup>0</sup>	1	20	Single	Rusted /Replacement required	

48	Lat 10.889992 <sup>0</sup> Long 49.266331 <sup>0</sup>	1.5	29	Single	Rusted /Replacement required	
49	Lat 10.862446 <sup>0</sup> Long 49.262129 <sup>0</sup>	1	24	Single	Rusted /Replacement required	
50	Lat 10.851657 <sup>0</sup> Long 49.261488 <sup>0</sup>	1	21	Single	Rusted /Replacement required	

### 8.7.3 Shoulder Erosion for Section 7- Carmo-Bosaso

✓ Team observed on this Section 4.200km Defected Shoulder

Table 28: Shoulder Erosion for Section 7- Carmo-Bosaso									
No.	Start Coordinates		End coordinates		L	W	D	Shoulder Defects (RM4)	Proposed Improvement Measures
142	10.59574° N	49.05083° E	11.213 44°N	49.19156°N	2350	0.6	0.05	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing
143	10.59574° N	49.05083° E	11.213 44°N	49.19156°N	1850	0.5	0.05	Shoulder erosion	Construction of shoulder pavement and applying single surface dressing

**8.7.4 Photos: Shoulder erosion for Section 7- Carmo-Bosaso**



**SHOULDER EROSION (RM4)  
@ ARMO-BOSASO SECTION**



**SHOULDER EROSION (RM4)@  
ARMO-BOSASO SECTION**



**SHOULDER EROSION (RM4)  
@ ARMO-BOSASO SECTION**



**SHOULDER EROSION (RM4)  
@ ARMO-BOSASO SECTION**



**SHOULDER EROSION (RM4)@  
ARMO-BOSASO SECTION**



**SHOULDER EROSION (RM4)  
@ ARMO-BOSASO SECTION**



### 8.7.5 Status of Washed Embankment for Section 7- Carmo-Bosaso

✓ The length of the washed Embankments is 472m

Table 29: Status of Washed Embankment for Section 7- Carmo-Bosaso								
NO	START COORDINATES		END COORDINATES		LENGTH	AVERAGE DEPTH	DEFECTS (RM5)	Proposed improvement measure
26	10.71980° N	49.14669° E	10.72054°N	49.14769° E	160	0.5	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
27	10.76831° N	49.21428° E	10.76926°N	49.21471° E	60	0.2	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
28	10.76925° N	49.21470° E	10.76939°N	49.21479° E	32	1.1	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.
29	10.79179° N	49.22189° E	10.79941°N	49.22271° E	220	0.8	Washed embankment	Excavation and removal of all debris materials and filling and compacting by layers from approval material in order to restore the original shape.

**8.7.6 Photos: Washed Embankment for Section 7- Carmo-Bosaso**



### 8.7.7 Status of Drianaage for Section 7- Carmo-Bosaso

✓ The length of drain canals is 775m

Table 30: Status of Drianaage for Section 7- Carmo-Bosaso								
N O	START COORDINATES		END COORDINATES		LE NG TH	AVERAG E DEPTH	DEFECTS (RM3)	PRPOSED IMPROVEMENT MEASURE
4	11.06903° N	49.18837 °E	11.06798° N	49.18813 °E	17 5	0.5	the debris materials accumulated in the party of the side drain canals .	Removing of accumulated debris materials in party of the side drain canals.
5	11.06908° N	49.18838 °E	11.06799° N	49.18816 °E	15 0	0.5	the debris materials accumulated in the party of the side drain canals .	Removing of accumulated debris materials in party of the side drain canals.
6	11.03713° N	49.18853 °E	11.03456° N	49.18821 °E	25 0	0.5	the debris materials accumulated in the party of the side drain canals .	Removing of accumulated debris materials in party of the side drain canals.
7	11.03717° N	49.18857 °E	11.03458° N	49.18826 °E	20 0	0.5	the debris materials accumulated in the party of the side drain canals .	Removing of accumulated debris materials in party of the side drain canals.



**8.7.8 Photos: Drainage for Section 7- Carmo-Bosaso**



### 8.7.9 Status of Potholes for Section 7- Carmo-Bosaso

- ✓ The number of small size potholes are 152 pcs
- ✓ The number of small size potholes are 12 pcs
- ✓ The number of small size potholes are 22 pcs

Table 31: Status of Potholes for Section 7- Carmo-Bosaso						
Coordinates		Pothole sizes			Defect (RM7)	Solution
Start	End	Small (0.5x0.5 x0.04)	Medium (0.8x1.0 x0.05)	Large (1.2x1.8 x0.05)		
10.59574049.05083	11.21344049.19156	152	12	22	The party of the carriage way was devastated by rains and heavy traffic activity and then called Potholes	The repair works involves cutting edges around the potholes and excavation down to the sub grade and then filling and compacting for approval material applying double surface Dressing



**8.7.10 Photos: Potholes for Section 7- Carmo-Bosaso**



**8.7.11 Vegetation for Section 7- Carmo-Bosaso**

- ✓ The team didn't identify any vegetation in this Section

**8.7.12 Damaged Stone Pitching for Section 7- Carmo-Bosaso**

- ✓ The team didn't identify any vegetation in this Section

## **Annex 1: Typical Routine Maintenance Activity List**

**RM1** : Inspection and Removal of obstructions

**RM2** : Desilting Culvert barrels and cleaning Culvert inlets and outlets.

**RM3** : Clean side, catch water and Mitre drains.

**RM4** : Repair erosion on shoulders.

**RM5** : Repair erosion lining and scour protection.

**RM6** : Total replacement of the corrugated iron pipe culverts(New).

**RM7** : Fill potholes and ruts in the carriageway.

**RM9** : Clear Vegetation

**RM10** : Repair dry Masonry and gabion retaining walls.

**RM 11** : Repair culvert headwalls

**RM 13** : other Maintenance activity as instructed by the supervisor including the following;

- Removal of protruding stones from carriageway
- Excavate and load gravel material for stock piling along the road.
- Supply of labour for major maintenance/repair works.
- Enviromental protection works eg, plant trees , erect erosion barriers.
- Excavation and removal on material deposits on drift surfaces e.g. sand and stones

## **Annex 2: Terms and Definitions**

**Carriageway:** The portion of the roadway including the various traffic Lanes and auxiliary lanes but excluding shoulders.

**Culvert:** A drainage structure which provides an opening under the carriage or median for the passage of water.

**Drainage Structures:** All road structuresd the discharges storm-water drainages and their protection structures -- it includes pipe culverts, Box culverts, Bridges.

**Highway:** A general term denoting a public way for purposes of vehicular travel including the entire area within the right – of – way .

**Inlet and Outlet Drainage Channels:** channels leading into or discharging from culverts, storm-water drains and minor bridges.

**Shoulder:** (a)when referring to this as a surface: the area between the outside edge of the travelled way and shoulder breakpoint.

(b) When referring to this as a pavement layer: the upper pavement layer lying between the outside edge of the base and the shoulder breakpoint.

**Structures:** Bridges , Culverts , catch basins , drop inlets, manholes , retaining wall , cribbing, end walls , buildings , sewers , service pipes , underdrains , and other miscellaneous items , which may be encountered in the work, and which are not classified herein.

**Stone pitching:** a single course of stones placed on edge with spalls rammed into the spaces between the stones.

**Embarkment:** that portion of the road prism composed of approved fill material which lies above the original ground and is bounded by the side slopes , described in the contract , extended down wards and outwards from the outer shoulder breakpoints and which the pavement is constructed .

**RM :** Stands for Routine Maintenance.

### **Annex 3: Field trip Assessment Information from Garowe to Bossaso**

On Sunday Feb. 27. 2022 a PHA expedition team headed by the lead engineer of the agency Eng.Said Mohamed departed from Garowe to Bossaso with the purpose of assessing the status of damaged sections of along the main tarmac road between Garowe-Bossaso section.

The expedition team composed of;

Eng. Said Mohamed Said

Eng. Abshir Mohamed Muse

Eng. Mohamud Dahir Said

Eng. Abdi-mahad Mohamed farah

### **Annex 4: Purpose of the field expedition**

The purpose of this field trip is regarding an assessment and evaluation of the damaged sections on the main tarmac road between Garowe-Bossaso, on the other hand PHA CEO assigned an additional works which are site inspections of the ongoing projects works including Haji-khayr

road rehabilitation project, construction of qayaadsame bridge and 45 new construction of concrete pipe culverts from Kalabayr village to Bosaso.

On the 27,feb 2022, the PHA team started an assessment of shoulder erosion and corrugated steel pipes culverts for very close spots after the Garowe check point and whole day spent between the Garowe check point to Libaho village. The PHA team stay overnight in Dangoroyo town and next morning on 28 Feb. returned to assess the remaining sections from Libaho to Dangorayo and continued assessment from Dangorayo to Haji KHayr village on the same day, in the evening of 1<sup>st</sup> March the expedition team came back to Dangorayo to stay overnight again.

In the early next morning of 2 March started an assessment works from Haji KHayr village to Gardho due to the massive works that the team reached Gardo in the late evening and stay overnight there. On the March 3 started an assessment works again started from Gardo to Waaciye by counting many potholes in different sizes. for that, the team were reached waaciye in the late evening and stay overnight there.

In the early morning of March 4, resume the assessment works again from Waaciye to Bosaso where there are many defected spots in different activities. The team reached late at kalabayr area and stay overnight in Bosaso. In the next morning of March 5, returned to complete the remaining sections including inspection of 45 new construction concrete pipe culverts in terms of inspection to ensure quality and quantity for above mentioned culverts has been completed and again stay overnight in Bosaso which is our final destination. On March 6, the expedition team departed from Bosaso city back to qayaadsame bridge for inspection of quality and quantity of the contract works has been completed at qayaadsame bridge and stay overnight in Gardo.

On March 7, the PHA team departed from Gardo to Haji-khayr road rehabilitation project in order to make monitor the progress of the contract works and percentage of the contract works achieved by the contractor. However, the team came back in the evening of 7 march to Garowe city.

## Annex 5: Bill of quantities for the 7 sections

Table 32 Bill of quantities for sections

<b>BILL OF QUANTITY FOR GAROWE - BOSASO ROAD REHABILITATION PROJECT</b>					
<b>SECTION ONE: GAROWE - SINUJIIF ROAD</b>					
<b>S.No</b>	<b>DESCRIPTION</b>	<b>UNIT</b>	<b>QTY</b>	<b>RATE</b>	<b>AMOUNT</b>
<b>SR1000</b>	<b>PRELIMINARY &amp; GENERAL WORLKS</b>				
1.1	Supply, deliver, install and maintain temporary project site and facility to ensure the engineers from the contractor and supervising engineers from the government authority during the project going on	LS	1	\$ 4,500.00	\$ 4,500.00
1.2	The mobilization & Demobilization of the equipment and personal to the project site	LS	1	\$ 9,000.00	\$ 9,000.00
1.3	The provision of the laboratory material testing services by taking samples of construction materials and completed works	LS	1	\$ 2,000.00	\$ 2,000.00
1.4	provision of traffic safety equipment includes concrete barricades signs and provision of traffic lights powered in solar	LS	1	\$1,500.00	\$ 1,500.00
1.5	Traffic control officials from the government department responsible for traffic management	LS	1	\$ 2,000.00	\$ 2,000.00
	<b>Sub Total for Series 1000</b>			<b>\$19,000.00</b>	
<b>SR2000</b>	<b>DRAINAGE STRUCTURES</b>				
2.1	Construction of new concrete pipe culvert: - Single line concrete pipe culvert, 1000 mm dimensions	No	4	\$13,800.00	\$ 55,200.00
2.2	Repairing of exist pipe culverts: - cleaning inside the culvert pipe, repairing the damages of the Gabions and Apron slab	NO	17	\$ 1,200.00	\$ 20,400.00



2.3	Repairing of exist pipe culverts: - cleaning of culverts Debris and Clearing Vegetation inlet and outlet of the culverts	No	20	\$ 200.00	\$ 4,000.00
<b>Sub Total for Series 2000</b>				<b>\$ 79,600.00</b>	
<b>SR3000</b>	<b>BITUMINOUS SURFACING</b>				
3.1	Gravel Wearing course on shoulder;- constructed from gravel taken cut or borrow	M2	35,717.85	\$ 5.00	\$ 178,589.25
3.2	Surface Dressing;- provide and lay bituminous surface dressing by laying surface layer on the surface of the road.	KM	37.1665	\$47,450.00	\$ 1,763,550.43
<b>Sub Total for Series 3000</b>				<b>\$1,942,140</b>	
<b>SR4000</b>	<b>DIVERSION ROAD</b>				
3.1	Construction of 6.0m wide temporary road diversion in natural gravel material sourced	KM	5.00	\$5,000.00	\$ 25,000.00
<b>Sub Total for Series 4000</b>				<b>\$ 25,000.00</b>	
<b>TOTAL COST FOR SECTION A</b>				<b>\$ 2,065,739.68</b>	
<b>SUPERVISION COST</b>			3%	<b>\$ 51,643.49</b>	
<b>CONTIGENCY</b>			5%	<b>\$ 103,286.98</b>	
<b>GRAND TOTAL</b>				<b>\$ 2,220,670.15</b>	

**SUMMARY SHEET: GAROWE-SINUJIIF ROAD SECTION**

SN	DESCRIPTION	AMOUNT
1000	PRELIMINARY & GENERAL WORKS	\$ 19,000.00
2000	DRAINAGE STRUCTURE	\$ 79,600.00
3000	BITUMINOUS SURFACING	\$ 1,942,140
4000	DIVERSION ROAD	\$ 25,000.00
	SUPERVISION COST	\$ 51,643.49
	CONTIGENCY	\$ 103,286.98
	<b>GRAND TOTAL</b>	<b>\$ 2,220,670.15</b>

## BILL OF QUANTITY FOR GAROWE - BOSASO ROAD REHABILITATION PROJECT

### SECTION TWO: SIN UJIIF - DANGORAYO ROAD

S.No	DESCRIPTION	UNIT	QTY	RATE USD	AMOUNT USD
<b>SR1000</b>	<b>PRELIMINARY &amp; GENERAL WORKS</b>				
1.1	Supply, deliver, install and maintain temporary project site and facility to ensure the engineers from the contractor and supervising engineers from the government authority during the project going on	LS	1	\$ 5,000.00	\$ 5,000.00
1.2	The mobilization of the equipment and personal to the project site	LS	1	\$ 9,500.00	\$ 9,500.00
1.3	The provision of the laboratory material testing services by taking samples of construction materials and completed works	LS	1	\$ 2,000.00	\$ 2,000.00
1.4	provision of traffic safety equipment includes concrete barricades signs and provision of traffic lights powered in solar	LS	1	\$ 1,500.00	\$ 1,500.00
1.5	Traffic control officials from the government department responsible for traffic management	LS	1	\$ 2,000.00	\$ 2,000.00
	<b>Sub Total for Series 1000</b>			<b>\$20,000.00</b>	
<b>SR2000</b>	<b>DRAINAGE STRUCTURES</b>				
2.1	<b>Repairing of exist pipe culverts:</b> - cleaning inside the culvert pipe, repairing the damages of the Gabions and Apron slab	NO	5	\$ 1,200.00	\$ 6,000.00
2.2	<b>Repairing of exist pipe culverts:</b> - cleaning of culverts Debris and Clearing Vegetation inlet and outlet of the culverts	No	5	\$ 200.00	\$ 1,000.00
	<b>Sub Total for Series 2000</b>				<b>\$ 7,000.00</b>

<b>SR3000</b>	<b>BITUMINOUS SURFACING</b>				
3.1	<b>Gravel Wearing course on shoulder;-</b> constructed from gravel taken cut or borrow	M2	2,793.00	\$ 5.00	\$ 13,965.00
3.2	<b>Surface Dressing;-</b> provide and lay bituminous surface dressing by laying surface layer on the surface of the road.	KM	4.72	\$47,450.00	\$ 223,964.00
	<b>Sub Total for Series 3000</b>		<b>\$ 237,929.00</b>		
<b>SR4000</b>	<b>ROAD EMBARKMENT</b>				
4.1	<b>Cutting of road failed section;-</b> cut the damaged road embankment to the depth between 100 - 200mm including the removal of unsuitable spoil surface materials.	M2	11.00	\$ 1.00	\$ 11.00
4.2	<b>Natural Gravel;-</b> provide, lay and compact natural gravel material in road embankment including the cut or borrow the gravel from approved pit	M3	55.0000	\$ 11.00	\$ 605.00
	<b>Sub Total for Series 4000</b>		<b>\$ 616.00</b>		
<b>SR5000</b>	<b>PROTECTION STRUCTURES</b>				
5.1	<b>Rip rap Masonry Stone;-</b> rehabilitate and reconstruct the riprap stone masonry with cement mortar 1:4 fine pointed in cascades.	M2	11.70	\$ 14.00	\$ 163.80
	<b>Sub Total for Series 4000</b>		<b>\$ 164.00</b>		
<b>SR6000</b>	<b>DIVERSION ROAD</b>				
6.1	Construction of 6.0m wide temporary road diversion in natural gravel material sourced	KM	3.00	\$ 5,000.00	\$ 15,000.00
	<b>Sub Total for Series 6000</b>		<b>\$ 15,000.00</b>		
	<b>Total Cost for Section Two</b>		<b>\$ 280,709.00</b>		
	<b>SUPERVISION COST</b>	3%	<b>\$ 8,421.27</b>		
	<b>CONTINGENCY</b>	5%	<b>\$ 14,035.45</b>		
	<b>GRAND TOTAL</b>		<b>\$ 303,165.72</b>		

**SUMMARY SHEET: SIN UJIIF - DANGORAYO ROAD SECTION**

	<b>SN</b>	<b>DESCRIPTION</b>	<b>AMOUNT</b>
	1000	PRELIMINARY & GENERAL WORKS	\$ 20,000.00
	2000	DRAINAGE STRUCTURE	\$ 7,000.00
	3000	BITUMINOUS SURFACING	\$ 237,929
	4000	ROAD EMBANKMENT	\$ 616.00
	5000	PROTECTION STRUCTURES	\$ 164.00
	6000	DIVERSION ROAD	\$ 15,000.00
		SUPERVISION COST	\$ 8,421.27
		CONTIGENCY	\$ 14,035.45
		<b>GRAND TOTAL</b>	<b>\$ 303,165.72</b>

## BILL OF QUANTITY (BOQ) GAROWE - BOSASO ROAD REHABILITATION PROJECT

### SECTION THREE: DANGORAYO-HAJIKHAYR ROAD

S.No	DESCRIPTION	UNIT	QTY	RATE USD	AMOUNT USD
<b>SR1000</b>	<b>Preliminary and General Works</b>				
1.1	Supply, deliver, install and maintain temporary project site and facility to ensure the engineers from the contractor and supervising engineers from the government authority during the project going on	LS	1	\$ 5,500.00	\$ 5,500.00
1.2	The mobilization of the equipment and personal to the project site	LS	1	\$10,000.00	\$ 10,000.00
1.3	The provision of the laboratory material testing services by taking samples of construction materials and completed works	LS	1	\$ 2,000.00	\$ 2,000.00
1.4	provision of traffic safety equipment includes concrete barricades signs and provision of traffic lights powered in solar	LS	1	\$ 1,500.00	\$ 1,500.00
1.5	Traffic control officials from the government department responsible for traffic management	LS	1	\$ 2,000.00	\$ 2,000.00
	<b>Sub Total for Series 1000</b>			<b>\$ 21,000.00</b>	
<b>SR2000</b>	<b>DRAINAGE STRUCTURES</b>				
2.1	<b>Construction of new concrete pipe culvert:</b> - Single line concrete pipe culvert, 1000mm dimensions	NO	5	\$ 13,800.00	\$ 69,000.00
2.2	<b>Repairing of exist pipe culverts:</b> - cleaning inside the culvert pipe, repairing the damages of the Gabions and Apron slab	NO	13	\$ 1,200.00	\$ 15,600.00



2.3	Repairing of exist pipe culverts: - cleaning of culverts Debris and Clearing Vegetation inlet and outlet of the culverts	No	5	\$ 200.00	\$ 1,000.00
	<b>Sub Total for Series 2000</b>				<b>\$ 85,600.00</b>
<b>SR3000</b>	<b>BITUMINOUS SURFACING</b>				
3.1	Gravel Wearing course on shoulder;- constructed from gravel taken cut or borrow	M2	5,698.60	\$ 5.00	\$ 28,493.00
3.2	Surface Dressing;- provide and lay bituminous surface dressing by laying surface layer on the surface of the road.	KM	7.60	\$47,450.00	\$ 360,667.45
	<b>Sub Total for Series 3000</b>			<b>\$ 389,160.45</b>	
<b>SR4000</b>	<b>ROAD EMBARKMENT</b>				
4.1	Cutting of road failed section;- cut the damaged road embankment to the depth between 100 - 200mm including the removal of unsuitable spoil surface materials.	M2	322.00	\$ 1.00	\$ 322.00
4.2	Natural Gravel;- provide, lay and compact natural gravel material in road embankment including the cut or borrow the gravel from approved pit	M3	5,000.00	\$ 11.00	\$ 55,000.00
	<b>Sub Total for Series 4000</b>			<b>\$ 55,322.00</b>	
<b>SR5000</b>	<b>PROTECTION STRUCTURES</b>				
5.1	Rip rap Masonry Stone;- rehabilitate and reconstruct the riprap stone masonry with cement mortar 1:4 fine pointed in cascades.	M2	83.45	\$ 14.00	\$ 1,168.30
	<b>Sub Total for Series 5000</b>			<b>\$ 1,168.30</b>	
<b>SR6000</b>	<b>DIVERSION ROAD</b>				
6.1	Construction of 6.0m wide temporary road diversion in natural gravel material sourced	KM	5.00	\$ 5,000.00	\$ 25,000.00
	<b>Sub Total for Series 6000</b>			<b>\$ 25,000.00</b>	
	<b>Total Cost for Section Three</b>				<b>\$ 577,250.75</b>
	<b>SUPERVISION COST</b>		<b>3%</b>		<b>\$17,317.52</b>

	<b>CONTIGENCY</b>	<b>5%</b>	<b>\$ 28,862.54</b>
	<b>GRAND TOTAL</b>		<b>\$ 623,430.81</b>
<b>SUMMARY SHEET: DANGORAYO-HAJIKHAYR ROAD SECTION</b>			
	<b>SN</b>	<b>DESCRIPTION</b>	<b>AMOUNT</b>
	1000	PRELIMINARY & GENERAL WORKS	\$ 21,000.00
	2000	DRAINAGE STRUCTURE	\$ 85,600.00
	3000	BITUMINOUS SURFACING	\$ 389,160.45
	4000	ROAD EMBANKMENT	\$ 55,322.00
	5000	PROTECTION STRUCTURES	\$ 1,168.30
	6000	DIVERSION ROAD	\$ 25,000.00
		SUPERVISION COST	\$ 17,317.52
		CONTIGENCY	\$ 28,862.54
		<b>GRAND TOTAL</b>	<b>\$ 623,430.81</b>

## BILL OF QUANTITY (BOQ) GAROWE - BOSASO ROAD REHABILITATION PROJECT

### SECTION FOUR: HAJIKHAYR-QARDHO ROAD

S.No	DESCRIPTION	UNIT	QTY	RATE USD	AMOUNT USD
<b>SR1000</b>	<b>Preliminary and General Works</b>				
1.1	Supply, deliver, install and maintain temporary project site and facility to ensure the engineers from the contractor and supervising engineers from the government authority during the project going on	LS	1	\$ 6,000.00	\$ 6,000.00
1.2	The mobilization of the equipment and personal to the project site	LS	1	\$ 10,500.00	\$ 10,500.00
1.3	The provision of the laboratory material testing services by taking samples of construction materials and completed works	LS	1	\$ 2,000.00	\$ 2,000.00
1.4	provision of traffic safety equipment includes concrete barricades signs and provision of traffic lights powered in solar	LS	1	\$ 1,500.00	\$ 1,500.00
1.5	Traffic control officials from the government department responsible for traffic management	LS	1	\$ 2,000.00	\$ 2,000.00
	<b>Sub Total for Series 1000</b>				<b>\$ 22,000.00</b>
<b>SR2000</b>	<b>DRAINAGE STRUCTURES</b>				
2.1	<b>Construction of new concrete pipe culvert:</b> - Sigle line concrete pipe culvert, 1000mm dimensions	NO	3	\$ 13,800.00	\$ 41,400.00
2.2	<b>Repairing of exist pipe culverts:</b> - cleaning inside the culvert pipe, repairing the damages of the Gabions and Apron slab	NO	35	\$ 1,200.00	\$ 42,000.00

2.3	<b>Repairing of exist pipe culverts:</b> - cleaning of culverts Debris and Clearing Vegetation inlet and outlet of the culverts	No	13	\$ 200.00	\$ 2,600.00
	<b>Sub Total for Series 2000</b>				<b>\$ 86,000.00</b>
<b>SR3000</b>	<b>BITUMINOUS SURFACING</b>				
3.1	<b>Gravel Wearing course on shoulder;</b> - constructed from gravel taken cut or borrow	M2	5,080.00	\$ 5.00	\$ 25,400.00
3.2	<b>Surface Dressing;</b> - provide and lay bituminous surface dressing by laying surface layer on the surface of the road.	KM	7.38	\$ 47,450.00	\$ 350,181.00
	<b>Sub Total for Series 3000</b>				<b>\$ 375,581.00</b>
<b>SR4000</b>	<b>ROAD EMBARKMENT</b>				
4.1	<b>Cutting of road failed section;</b> - cut the damaged road embankment to the depth between 100 - 200mm including the removal of unsuitable spoil surface materials.	M2	287.20	\$ 1.00	\$ 287.20
4.2	<b>Natural Gravel;</b> - provide, lay and compact natural gravel material in road embankment including the cut or borrow the gravel from approved pit	M3	3,902.80	\$ 11.00	\$ 42,930.80
	<b>Sub Total for Series 4000</b>				<b>\$ 43,218.00</b>
<b>SR5000</b>	<b>PROTECTION STRUCTURES</b>				
5.1	<b>Rip rap Masonry Stone;</b> - rehabilitate and reconstruct the riprap stone masonry with cement mortar 1:4 fine pointed in cascades.	M2	104.54	\$ 14.00	\$ 1,463.56
	<b>Sub Total for Series 5000</b>				<b>\$ 1,463.56</b>
<b>SR6000</b>	<b>CLEAR VEGETATION</b>				
6.1	<b>Cutting of overgrown vegetation and removal thorn bush away from the road</b>	KM	5.95	\$ 500.00	\$ 2,975.00
	<b>Sub Total for Series 6000</b>				<b>\$ 2,975.00</b>
<b>SR7000</b>	<b>DIVERSION ROAD</b>				

7.1	Construction of 6.0m wide temporary road diversion in natural gravel material sourced	KM	6.00	\$ 5,000.00	\$ 30,000.00
<b>Sub Total for Series 6000</b>					<b>\$ 30,000.00</b>
<b>Total Cost for Section Three</b>					<b>\$ 561,237.56</b>
<b>SUPERVISION COST</b>				<b>3%</b>	<b>\$ 16,837.13</b>
<b>CONTIGENCY</b>				<b>5%</b>	<b>\$ 28,061.88</b>
<b>GRAND TOTAL</b>					<b>\$ 606,136.56</b>

**SUMMARY SHEET: HAJIKHAYR-GARDO ROAD SECTION**

	SN	DESCRIPTION	AMOUNT
	1000	PRELIMINARY & GENERAL WORKS	\$ 22,000.00
	2000	DRAINAGE STRUCTURE	\$ 86,000.00
	3000	BITUMINOUS SURFACING	\$ 375,581.00
	4000	ROAD EMBANKMENT	\$ 43,218.00
	5000	PROTECTION STRUCTURES	\$ 1,463.56
	6000	CLEAR VEGETATION	\$ 2,975.00
	7000	DIVERSION ROAD	\$ 30,000.00
		SUPERVISION COST	\$ 16,837.13
		CONTIGENCY	\$ 28,061.88
		<b>GRAND TOTAL</b>	<b>\$ 606,136.56</b>



## BILL OF QUANTITY (BOQ) GAROWE - BOSASO ROAD REHABILITATION PROJECT

### SECTION FIVE: QARDO -WACIYE ROAD

S.No	DESCRIPTION	UNIT	QTY	RATE USD	AMOUNT USD
<b>SR1000</b>	<b>Preliminary and General Works</b>				
1.1	Supply, deliver, install and maintain temporary project site and facility to ensure the engineers from the contractor and supervising engineers from the government authority during the project going on	LS	1	\$ 6,500.00	\$ 6,500.00
1.2	The mobilization of the equipment and personal to the project site	LS	1	\$ 11,000.00	\$ 11,000.00
1.3	The provision of the laboratory material testing services by taking samples of construction materials and completed works	LS	1	\$ 2,000.00	\$ 2,000.00
1.4	provision of traffic safety equipment includes concrete barricades signs and provision of traffic lights powered in solar	LS	1	\$1,500.00	\$ 1,500.00
1.5	Traffic control officials from the government department responsible for traffic management	LS	1	\$ 2,000.00	\$ 2,000.00
	<b>Sub Total for Series 1000</b>			<b>\$ 23,000.00</b>	
<b>SR2000</b>	<b>DRAINAGE STRUCTURES</b>				
2.1	<b>Repairing of exist pipe culverts:</b> - cleaning inside the culvert pipe, repairing the damages of the Gabions and Apron slab	NO	20	\$1,200.00	\$ 24,000.00
2.2	<b>Repairing of exist pipe culverts:</b> - cleaning of culverts Debris and Clearing Vegetation inlet and outlet of the culverts	No	8	\$ 200.00	\$ 1,600.00
	<b>Sub Total for Series 2000</b>				<b>\$ 25,600.00</b>

<b>SR3000</b>	<b>BITUMINOUS SURFACING</b>				
3.1	<b>Gravel Wearing course on shoulder;-</b> constructed from gravel taken cut or borrow	M2	1,440.30	\$ 5.00	\$ 7,201.50
3.2	<b>Surface Dressing;-</b> provide and lay bituminous surface dressing by laying surface layer on the surface of the road.	KM	3.0	\$ 47,450.00	\$141,780.60
	<b>Sub Total for Series 3000</b>			<b>\$ 148,982.10</b>	
<b>SR4000</b>	<b>ROAD EMBARKMENT</b>				
4.1	<b>Cutting of road failed section;-</b> cut the damaged road embankment to the depth between 100 - 200mm including the removal of unsuitable spoil surface materials.	M2	205.00	\$ 1.00	\$ 205.00
4.2	<b>Natural Gravel;-</b> provide, lay and compact natural gravel material in road embankment including the cut or borrow the gravel from approved pit	M3	1,808.00	\$ 11.00	\$ 19,888.00
	<b>Sub Total for Series 4000</b>			<b>\$ 20,093.00</b>	
<b>SR5000</b>	<b>PROTECTION STRUCTURES</b>				
5.1	<b>Rip rap Masonry Stone;-</b> rehabilitate and reconstruct the riprap stone masonry with cement mortar 1:4 fine pointed in cascades.	M2	19.50	\$ 14.00	\$ 273.00
	<b>Sub Total for Series 5000</b>			<b>\$ 273.00</b>	
<b>SR6000</b>	<b>CLEAR VEGETATION</b>				
6.1	<b>Cutting of overgrown vegetation and removal thorn bush away from the road</b>	KM	10.35	\$ 500.00	\$ 5,175.00
	<b>Sub Total for Series 6000</b>			<b>\$ 5,175.00</b>	
<b>SR7000</b>	<b>POTHOLE REPAIR WORKS</b>				
7.1	<b>Pothole repair works on the carriage way</b>	NO	2,162.00	\$ 18.00	\$ 38,916.00
	<b>Sub Total for Series 7000</b>			<b>\$ 38,916.00</b>	
<b>SR8000</b>	<b>DIVERSION ROAD</b>				

8.1	Construction of 6.0m wide temporary road diversion in natural gravel material sourced	KM	1.00	\$ 5,000.00	\$ 5,000.00
<b>Sub Total for Series 8000</b>				<b>\$ 5,000.00</b>	
<b>Total Cost for Section Five</b>				<b>\$ 267,039.10</b>	
<b>SUPERVISION COST</b>			<b>3%</b>	<b>\$ 8,011.17</b>	
<b>CONTIGENCY</b>			<b>5%</b>	<b>\$ 13,351.96</b>	
<b>GRAND TOTAL</b>				<b>\$ 288,402.23</b>	
<b>SUMMARY SHEET: GARDO-WACIYE ROAD SECTION</b>					
	<b>SN</b>	<b>DESCRIPTION</b>	<b>AMOUNT</b>		
	1000	PRELIMINARY & GENERAL WORKS	\$	23,000.00	
	2000	DRAINAGE STRUCTURE	\$	25,600.00	
	3000	BITUMINOUS SURFACING	\$	148,982.10	
	4000	ROAD EMBANKMENT	\$	20,093.00	
	5000	PROTECTION STRUCTURES	\$	273.00	
	6000	CLEAR VEGETATION	\$	5,175.00	
	7000	POTHOLE REPAIR WORKS	\$	38,916.00	
	7000	DIVERSION ROAD	\$	5,000.00	
		SUPERVISION COST	\$	8,011.17	
		CONTIGENCY	\$	13,351.96	
		<b>GRAND TOTAL</b>	<b>\$</b>	<b>288,402.23</b>	

## BILL OF QUANTITY (BOQ) GAROWE - BOSASO ROAD REHABILITATION PROJECT

### SECTION SIX: WACIYE-CARMO ROAD

S.No	DESCRIPTION	UNIT	QTY	RATE USD	AMOUNT USD
<b>SR1000</b>	<b>Preliminary and General Works</b>				
1.1	Supply, deliver, install and maintain temporary project site and facility to ensure the engineers from the contractor and supervising engineers from the government authority during the project going on	LS	1	\$ 7,000.00	\$ 7,000.00
1.2	The mobilization of the equipment and personal to the project site	LS	1	\$ 11,500.00	\$ 11,500.00
1.3	The provision of the laboratory material testing services by taking samples of construction materials and completed works	LS	1	\$ 2,000.00	\$ 2,000.00
1.4	provision of traffic safety equipment includes concrete barricades signs and provision of traffic lights powered in solar	LS	1	\$ 1,500.00	\$ 1,500.00
1.5	Traffic control officials from the government department responsible for traffic management	LS	1	\$ 2,000.00	\$ 2,000.00
	<b>Sub Total for Series 1000</b>			<b>\$ 24,000.00</b>	
<b>SR2000</b>	<b>DRAINAGE STRUCTURES</b>				
2.1	<b>Construction of new concrete pipe culvert: - Single line concrete pipe culvert, 1000mm dimensions</b>	NO	2	\$ 12,000.00	\$ 24,000.00
	<b>Sub Total for Series 2000</b>				<b>\$24,000.00</b>
<b>SR3000</b>	<b>BITUMINOUS SURFACING</b>				
3.1	<b>Gravel Wearing course on shoulder;- constructed from gravel taken cut or borrow</b>	M2	2,909.50	\$ 5.00	\$ 14,547.50

3.2	<b>Surface Dressing;</b> - provide and lay bituminous surface dressing by laying surface layer on the surface of the road.	KM	4.75	\$ 47,450.00	\$ 225,387.50
	<b>Sub Total for Series 3000</b>			<b>\$ 239,935.00</b>	
<b>SR4000</b>	<b>ROAD EMBARKMENT</b>				
4.1	<b>Cutting of road failed section;</b> - cut the damaged road embankment to the depth between 100 - 200mm including the removal of unsuitable spoil surface materials.	M2	121.20	\$ 1.00	\$ 121.20
4.2	<b>Natural Gravel;</b> - provide, lay and compact natural gravel material in road embankment including the cut or borrow the gravel from approved pit	M3	1,298.40	\$ 11.00	\$ 14,282.40
	<b>Sub Total for Series 4000</b>			<b>\$ 14,403.60</b>	
<b>SR5000</b>	<b>CLEAR VEGETATION</b>				
5.1	<b>Cutting of overgrown vegetation and removal thorn bush away from the road</b>	KM	3.80	\$ 500.00	\$ 1,900.00
	<b>Sub Total for Series 5000</b>			<b>\$ 1,900.00</b>	
<b>SR6000</b>	<b>POTHOLE REPAIR WORKS</b>				
6.1	<b>Pothole repair works on the carriage way</b>	NO	288.00	\$18.00	\$ 5,184.00
	<b>Sub Total for Series 7000</b>			<b>\$ 5,184.00</b>	
<b>SR7000</b>	<b>DRAINAGE CANALS OF THE ROAD</b>				
7.1	Remove debris materials from the drain canals	M3	384.00	\$5.00	\$ 1,920.00
7.2	Provide and construct reinforced concrete slaps for damaged sections of side drain	M3	384.00	\$300.00	\$115,200.00
	<b>Sub Total for Series 7000</b>			<b>\$ 117,120.00</b>	
<b>SR8000</b>	<b>DIVERSION ROAD</b>				
8.1	Construction of 6.0m wide temporary road diversion in natural gravel material sourced	KM	2.00	\$ 5,000.00	\$ 10,000.00
	<b>Sub Total for Series 8000</b>			<b>\$ 10,000.00</b>	



	<b>Total Cost for Section Six</b>		<b>\$ 436,542.60</b>
	<b>SUPERVISION COST</b>	<b>3%</b>	<b>\$ 13,096.28</b>
	<b>CONTIGENCY</b>	<b>5%</b>	<b>\$ 21,827.13</b>
	<b>GRAND TOTAL</b>		<b>\$ 471,466.01</b>

**SUMMARY SHEET: WACIYE-CARMO ROAD SECTION**

	<b>SN</b>	<b>DESCRIPTION</b>	<b>AMOUNT</b>
	1000	PRELIMINARY & GENERAL WORKS	\$ 24,000.00
	2000	DRAINAGE STRUCTURES	\$ 24,000.00
	3000	BITUMINOUS SURFACING	\$ 239,935.00
	4000	ROAD EMBANKMENT	\$ 14,403.60
	5000	CLEAR VEGETATION	\$ 1,900.00
	6000	POTHOLE REPAIR WORKS	\$ 5,184.00
	7000	DRAINAGE CANALS OF THE ROAD	\$ 117,120.00
	7000	DIVERSION ROAD	\$ 10,000.00
		SUPERVISION COST	\$ 13,096.28
		CONTIGENCY	\$ 21,827.13
		<b>GRAND TOTAL</b>	<b>\$ 471,466.01</b>

## BILL OF QUANTITY (BOQ) GAROWE - BOSASO ROAD REHABILITATION PROJECT

### SECTION SEVEN: CARMO-BOSASO ROAD

S.No	DESCRIPTION	UNIT	QTY	RATE USD	AMOUNT USD
<b>SR1000</b>	<b>PRELIMINARY &amp; GENERAL WORKS</b>				
1.1	Supply, deliver, install and maintain temporary project site and facility to ensure the engineers from the contractor and supervising engineers from the government authority during the project going on	LS	1	\$ 7,500.00	\$ 7,500.00
1.2	The mobilization of the equipment and personal to the project site	LS	1	\$ 12,000.00	\$ 12,000.00
1.3	The provision of the laboratory material testing services by taking samples of construction materials and completed works	LS	1	\$ 2,000.00	\$ 2,000.00
1.4	provision of traffic safety equipment includes concrete barricades signs and provision of traffic lights powered in solar	LS	1	\$ 1,500.00	\$ 1,500.00
1.5	Traffic control officials from the government department responsible for traffic management	LS	1	\$ 2,000.00	\$ 2,000.00
	<b>Sub Total for Series 1000</b>				<b>\$ 25,000.00</b>
<b>SR2000</b>	<b>DRAINAGE STRUCTURES</b>				
2.1	<b>Construction of new concrete pipe culvert:</b> - Sigle line concrete pipe culvert, 1000mm dimmensions	NO	50	\$ 12,000.00	\$ 600,000.00
	<b>Sub Total for Series 2000</b>				<b>\$ 600,000.00</b>
<b>SR3000</b>	<b>BITUMINOUS SURFACING</b>				
2.1	<b>Gravel Wearing course on shoulder;</b> - constructed from gravel taken cut or borrow	M2	2,335.00	\$ 5.00	\$ 11,675.00

2.2	Surface Dressing on shoulders;- provide and lay bituminous surface dressing by laying surface layer on the surface of the road.	KM	4.2	\$ 47,450.00	\$ 199,290.00
	<b>Sub Total for Series 3000</b>				<b>\$ 210,965.00</b>
<b>SR4000</b>	<b>ROAD EMBARKMENT</b>				
3.1	Cutting of road failed section;- cut the damaged road embankment to the depth between 100 - 200mm including the removal of unsuitable spoil surface materials.	M2	95.00	\$ 1.00	\$ 95.00
3.2	Natural Gravel;- provide, lay and compact natural gravel material in road embankment including the cut or borrow the gravel from approved pit	M3	606.5	\$ 11.00	\$ 6,671.50
	<b>Sub Total for Series 4000</b>				<b>\$ 6,766.50</b>
<b>SR5000</b>	<b>POTHOLE REPAIR WORKS</b>				
4.1	Pothole repair works on the carriage way	NO	186.0 0	\$ 18.00	\$ 3,348.00
	<b>Sub Total for Series 5000</b>				<b>\$ 3,348.00</b>
<b>SR6000</b>	<b>DRAINAGE CANALS OF THE ROAD</b>				
5.1	Remove debris materials from the drain canals	M3	310.0 0	\$ 5.00	\$ 1,550.00
	<b>Sub Total for Series 6000</b>				<b>\$ 1,550.00</b>
<b>SR7000</b>	<b>DIVERSION ROAD</b>				
6.1	Construction of 6.0m wide temporary road diversion in natural gravel material sourced	KM	20.00	\$ 5,000.00	\$ 100,000.00
	<b>Sub Total for Series 7000</b>				<b>\$ 100,000.00</b>
	<b>Total Cost for Section Six</b>				<b>\$ 947,629.50</b>
	<b>SUPERVISION COST</b>			<b>3%</b>	<b>\$ 28,428.89</b>
	<b>CONTIGENCY</b>			<b>5%</b>	<b>\$ 47,381.48</b>
	<b>GRAND TOTAL</b>				<b>\$ 1,023,439.86</b>

**SUMMARY SHEET: CARMO-BOSASO ROAD SECTION**

	1000	PRELIMINARY & GENERAL WORKS	\$	25,000.00
	2000	DRAINAGE STRUCTURE	\$	600,000.00
	3000	BITUMINOUS SURFACING	\$	210,965.00
	4000	ROAD EMBANKMENT	\$	6,766.50
	5000	POTHOLE REPAIR WORKS	\$	3,348.00
	6000	DRAINAGE CANALS OF THE ROAD	\$	1,550.00
	7000	DIVERSION ROAD	\$	100,000.00
		SUPERVISION COST	\$	28,428.89
		CONTIGENCY	\$	47,381.48
		<b>GRAND TOTAL</b>	<b>\$</b>	<b>1,023,439.86</b>

**MASHRUUCA DAYACTIRKA IYO DIB U DHISKA WADDOOYINKA PUNTLAND  
WEJIGIISA 2AAD**

**QIIMAHA GUUD EE SAGAALKA (7) GOOBOOD**

QAYBTA	GOOBTA	QIIMAHA
1	WADADA GAROWE - SINUJIIF	\$2,220,670.15
2	WADADA SINUJIIF- DANGORAYO	\$303,165.72
3	WADADA DANGORAYO- HAJIKHAYR	\$623,430.81
4	WADADA HAJIKHAYR- QARDHO	\$606,136.56
5	WADADA QARDHO-WACIYE	\$288,402.23
6	WADADA WACIYE-CARMO	\$471,466.01
7	WADADA CARMO-BOOSAASO	\$1,023,439.86
	<b>WADAR GUUD</b>	<b>\$5,536,711.34</b>



