Chapter 5 Project Description

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5 PROJECT DESCRIPTION

This chapter presents a description of the proposed works and addresses those engineering aspects of the WREP-SR Project that are relevant to the assessment of environmental and social impacts. The following topics are addressed:

- Location and footprint of the proposed works
- Basis of design, including the technical and performance requirements, and codes and standards used
- Description of the construction activities involved
- De-oiling and removal from service of the redundant sections of pipe
- Testing and commissioning
- Reinstatement and erosion control
- Project resources, wastes and emissions
- Operational control and maintenance.

Where aerial markers (AMs) or kilometre points (KPs) are noted, they relate to the nearest marker on the existing WREP unless they are preceded by a Section number (e.g. RR-001) in which case they are the distance from the start of that proposed new section of pipe. The various maps in the ESIA should be referred to for more precise information about locations.

Aspects of the project design that have been developed specifically to mitigate potential environmental or social impacts associated with this Project, have been included in the Commitments Register (Appendix E) and are identified in this chapter by a 4 digit reference number. These appear in parentheses at the end of the commitment. An example is given in the box below, where 17-21 is the reference number.

Example commitment:

In section RR-001 where the ROW is through dense woodland with high biodiversity value, the working width will be reduced (subject to constructability constraints) with the aim of minimising impacts on these areas (17-21).

5.1 Project Rationale

As part of an ongoing maintenance and integrity plan, WREP has been subjected to a number of reviews, studies and inspections, which have identified the following areas of concern for continued operation in Georgia:

Landslides: Georgia is a dynamic environment subject to constant geomorphological change brought about by geological and climatic influences. Three re-route sections have been identified to address slope stability issues.

River crossings: Similarly, rivers also represent a dynamic environment. Owing to bed and bank scouring the two crossings of the river Supsa have been identified for replacement.

Approximately 11.1 km will be re-routed away from the current alignment to avoid areas of instability. Two major river crossings will be replaced, totalling 2.5km.

Ducting for an optical-fibre intruder-detection system will be reinstalled over all re-routed pipeline sections.

5.2 Project Location and Footprint

5.2.1 Re-route Sections

The sections that are planned to be replaced under the SR Project are described in Table 5-1 and shown on the maps in Appendix A.

To identify specific locations or areas within the re-route sections, reference is made throughout this document to:

a) The nearest kilometre point (KP) on each new section e.g. RR-001 KP2.4 is 2.4km from the start of section RR-001
b) The number of the nearest aerial marker on the existing WREP and the distance from that marker e.g. section RR-001 starts at AM63+100, which is 100m along the existing pipeline from aerial marker 63. These locations are typically only accurate to the nearest 100m.
c) Grid references, where a greater level of accuracy is required.

Table 5-1: Location of Re-route Sections

Replacement/Re-route Section	Section Length (km)	Start point	End point
RP-001a	2.8	AM51+900	AM55+050
RR-001	7.6	AM 63+100	AM69+100
RR-004a	0.5	AM225	AM225+400
Supsa River WREP	0.9	AM371+500	AM373
Supsa River Export	1.6	AM373+200	AM374+500
Total Length Re-Routes	11.1km		
Total Length Replacement River Crossings	2.5km		
TOTAL LENGTH	13.6km		

Re-routing of the sections has considered the following factors:

- Minimising impacts on sensitive receptors (primarily ecology, cultural heritage, water resources and settlements)
- Enhancing pipeline stability
- Protecting pipeline from erosion risk
- Constructability (including topography and technical considerations)
- Third party and authority requirements (infrastructure planning and development)
- Hydraulic profile and limitations of existing pipeline infrastructure (pump station capacity)
- Crossings of linear features (watercourses, roads, underground services)
- Proximity to infrastructure (electricity transmission lines, road, rail etc.)
- Scope of proposed pipeline repairs (i.e. re-routing between defined sections).

The maximum right of way (ROW) corridor for pipeline construction and installation activities is determined according to topographical constraints (e.g. narrow ridges) and by environmental factors. Where there is no topographical or environmental constraint on the construction, a 25m ROW width has been selected in order to maximise construction efficiency.

In section RR-001 where the ROW is through dense woodland with high biodiversity value, the working width will be reduced (subject to constructability constraints) with the aim of minimising impacts on these areas (17-21).

In addition to the ROW corridor, construction areas have been identified at strategic locations. Where storage of materials (e.g. pipe, machinery and spoil) is anticipated, the construction areas will be located in open fields to minimise environmental impact. Small portable welfare cabins may also be placed in these construction areas for the security, health and safety of the workforce. Additional construction areas will also be required at crossings of existing infrastructure (such as pipelines or roads) to allow adequate space for excavation to the depths required to construct the crossing and for storage of excavated materials.

At the HDD river crossings, stringing sites will be required to allow welding of the pipeline before it is pulled under the river. These sites will be as long as the length of pipeline to be pulled under the river and 25m wide. The location of the HDD exit site and stringing area for the Supsa Export Pipeline crossing has changed since disclosure of the draft ESIA as explained in Section 4.4.5. The revised location is shown on the maps in Appendix A.

At the Supsa River crossings, a proposed GOGC pipeline may affect the final routing of the WREP-SR sections. Options are currently being considered to accommodate both the GOGC and WREP-SR projects at this confined and geotechnically complex location. If the need for a re-route is confirmed, this will be discussed with GOGC and MENRP, and an amendment to the ESIA will be provided.

5.2.2 Workers' Accommodation and Pipe Storage Areas

The Project will use existing hotels and guest houses as accommodation for the construction workers who do not live locally. If no suitable accommodation is available, the contractor will be required to upgrade an existing building. The development of a dedicated construction camp is not considered appropriate as this is a small scale project that will be undertaken in three geographically distinct locations.

Existing industrial facilities or storage yards will be used for storage of line pipe pending delivery to the ROW.

5.2.3 Access Roads

Following initial routing of the re-route sections, a survey of potential access routes was undertaken during 2015 as described in Section 4.6. The roads considered suitable for construction access are shown on the figures in Appendix A and are listed in Table 5-4. Access roads (AR) are numbered according to the nearest aerial marker (AM) on the existing WREP.

Some access roads may need to be upgraded by the construction contractor in order to transport equipment, materials and people to and from the work site.

It is currently envisaged that it will be necessary to build eight new short lengths of construction access roads:

1. AR52, which is required to access the start of RP-001a. The existing track at this location runs on top of the existing WREP pipeline and is therefore not suitable for transporting heavy machinery to site as this could damage the pipeline.
2. AR63a will include a short stretch (c. 60m) of new road in order to avoid Tbilisi National Park
3. AR66a is required to access sections of RR-001. The existing track at this location runs on top of the existing WREP pipeline and is therefore not suitable for

transporting heavy machinery to site as this could damage the pipeline. In addition the existing track is of a steep gradient with mud at the surface, which is extremely slippery when wet.

4. The final 40m of AR64.5a is required to connect the existing access track to the planned construction area.
5. Sections of AR225 (which is required to access RR-004a) run on top of the existing WREP pipeline and are therefore not suitable for transporting heavy machinery to site as this could damage the pipeline.
6. The final 25m of AR372 is required to connect the existing access track to the planned construction area.
7. AR373 is required to maintain operations access to the Supsa Terminal during construction of the Supsa Export HDD. It is also required to allow access to the Supsa WREP HDD exit site. The existing road will be blocked by the stringing site for the HDD.
8. AR374 is a planned short access road to the Supsa Export HDD entry site. There is no existing access road in this area.

5.2.4 Pipeline crossings

Crossings are defined as the intersection between the proposed pipeline route and pre-existing features such as watercourses, roads, tracks and underground services. Table 5-2 identifies linear features such as rivers, tracks and services that the ROW will cross and the corresponding construction technique. The major crossings are described in more detail and typical crossing drawings are provided in Section 5-19.

The identification of tracks used for cattle/sheep movement is ongoing as part of the process of land rights acquisition. The consequent data with consents from respective parties, including owners of 3rd party services, will be a part of the Construction Permit application package.

Table 5-2: Crossings Schedule

Section	Crossing	Local KP	Description	Methodology
RP-001a	Track	0.963	<20m	Open cut
	Track	1.605	<10m	Open cut
	Gully	2.444	<5m	Open cut
	Service	2.452	4" pipeline (GOGC)	Open cut
	Track	2.475	>5m	Open cut
	Track	2.575	>70m	Open cut
RR-001	Stream (Jokhtaniskhevi)	0.006	<5m width	Open cut
	Ditch	0.035	<5m width	Open cut
	Track	0.043	<5m width	Open cut
	Track	0.349	<5m width	Open cut
	Track	0.826	<5m width	Open cut
	Track	1.058	<5m width	Open cut
	Service	1.514	3 x HV overhead; ht = 20m	-
	Service	1.877	3 x HV overhead; ht = 20m	-
	Service	2.057	1 x HV overhead; ht = 20m	-
	Track	2.061	<5m width	Open cut

Section	Crossing	Local KP	Description	Methodology
	Ditch	2.068	<5m width	Open cut
	Service	2.375	2 x HV overhead; ht = 20m	-
	Track	2.408	<5m width	Open cut
	Track	2.436	<5m width	Open cut
	Service	2.652	3 x HV overhead; ht = 22m	-
	Track	2.67	<5m width	Open cut
	Stream (Jachviskhevi)	2.772	<5m width	Open cut
	Service	2.778	Buried Pipeline	Open cut
	Track	2.871	<5m width	Open cut
	Track	3.491	<5m width	Open cut
	Service	3.509	3 x HV overhead	-
	Track	3.616	<5m width	Open cut
	Service	3.628	Buried Pipeline (WREP)	Open cut
	Service	3.7	3 x HV overhead	-
	Service	4.216	3 x HV overhead	-
	Ditch	4.285	<5m width	Open cut
	Service	4.299	Buried Pipeline (WREP)	Open cut
	Track	4.302	<5m width	Open cut
	Ditch	4.312	<5m width	Open cut
	Stream	4.342	<5m width	Open cut
	Track	4.37	<5m width	Open cut
	Service	4.618	HV overhead	-
	Service	4.719	HV overhead	-
	Track	4.935	<5m width	Open cut
	Track	5.151	<5m width	Open cut
	Track	5.158	<5m width	Open cut
	Service	5.158	5 x HV overhead; ht = 13.5m	-
	Track	5.289	<5m width	Open cut
	Track	5.375	<5m width	Open cut
	Track	5.391	<5m width	Open cut
	Track	5.419	<5m width	Open cut
	Track	5.557	<5m width	Open cut
	Track	5.568	<5m width	Open cut
	Track	5.775	<5m width	Open cut
	Service	5.802	Buried pipeline (GOGC)	Open cut
	Track	5.803	<5m width	Open cut
	Ditch	6.127	<5m width	Open cut
	Track	6.266	<5m width	Open cut
	Track	6.342	<5m width	Open cut
	Track	6.915	<5m width	Open cut

Section	Crossing	Local KP	Description	Methodology
	Service	6.928	Buried water pipeline	Open cut
	Track	7.089	<5m width	Open cut
	Service	7.201	Buried plastic water pipeline	Open cut
	Track	7.213	<5m width	Open cut
	Service	7.216	Buried water pipeline	Open cut
	Service	7.22	Buried water pipeline	Open cut
	Gully	7.253	<10m width	Open cut
	Service	7.523	3 x HV overhead; ht = 20m	-
	Track	7.604	<5m width	Open cut
	Service	7.624	3 x HV overhead; ht = 18m	-
	Track	7.689	<5m width	Open cut
	Service	7.746	3 x HV overhead	-
	Track	7.838	<5m width	Open cut
RR-004a	Track	0.026	<5m width	Open cut
	Service	0.087	Buried pipeline	Open cut
	Track	0.315	<5m width	Open cut
	Service	0.459	Buried pipeline	Open cut
	Track	0.487	Track	Open cut
	Track	0.5	<5m width	Open cut
Supsa River Crossing	River		WREP Supsa River Crossing	HDD
	Stream			
	Track			
	Stream			
	Service		Fibre optic cable	Open cut
Supsa 36" Export River Crossing	Track		WREP Supsa Export Crossing	HDD
	Service			
	Track			
	Track			
	River			
	Track			
	Ditch			
	Ditch			
	Ditch		Ditch <5m width	Open cut
	Ditch		Ditch <5m width	Open cut
	Ditch		Ditch <5m width	Open cut

5.2.5 Borrow Pits

All excavated materials will be screened and re-used (e.g. for padding, backfilling etc.) to the extent deemed feasible by Company to minimise the need for new aggregates (1-07). The Project will give preference to using existing borrow pits where reasonably practical (1-

03). Aggregates will only be sourced from licensed sources as approved by MENRP (1-01) which will be identified in the Resource Management Plan[1].

If new borrow pits are necessary, their selection and use will be in accordance with criteria that will be defined in the Land Management Plan.

5.2.6 Spoil Disposal Sites

Where possible, surplus spoil will be spread over the ROW before topsoil reinstatement or will be taken to an approved landfill site. If neither option is suitable and local disposal is necessary, the contractor will adopt procedures that will be defined in the Land Management Plan.

5.2.7 Intruder Detection

Electronic protection against third-party interference is currently installed between KP22 and KP95 where there is a history of accidental and/or deliberate interference. Detection is based on interferometer measurements of changes in fibre-strain characteristics caused by vibration transmitted through the ground to a buried optical-fibre cable. This methodology has proved effective on the two sections of the BTC pipeline in Georgia where it is installed.

A 40mm diameter duct will be installed above all new sections of pipeline to accommodate intruder detection cable. At each pipeline tie-back point the ends of the duct will be blanked off to avoid ingress of soil or water, coiled and burred.

5.2.8 Land Acquisition

GPC has identified approximately 88 private land parcels and 136 state-owned land parcels that will be crossed by the new sections. Georgian legislation relating to land registration has changed since the WREP was developed in 1997/9. GPC is working with affected private landowners to register their land where this has not been completed, as this is a pre-requisite to the registration of servitude agreements to allow installation of the pipe sections. Both the replaced and re-routed sections of pipe will be subject to new legal agreements with the landowners.

On behalf of the State, the Georgian Oil and Gas Company (GOGC) will enter into registered servitude agreements with the landowners in order to subsequently grant to WREP-SR Project the land access rights. In general, there will be no transfer of ownership to the Company of land parcels within the pipeline corridor land at any stage during construction or operations (32-13). Instead, the access will be secured by compensation payments to land owners by GPC for the restrictions envisaged in the agreement which will affect land owners during construction. The owners will be allowed to resume, free of any charge, use of the land for agricultural production after construction under agreed re-use conditions. Re-use conditions are in general determined by the Georgian Pipeline Zoning Regulations[2].

The Company will compensate for crop loss across the ROW and other construction areas during the construction period in a specific area. Compensation will be in line with local market rates (23-14).

[1] Management Plans are described in Chapter 13.
[2] Decree No 365 of Prime Minister of Georgia, December 24, 2013, Tbilisi, On Establishing the Rule of Protection of Main Pipelines (Oil, Oil Products, Oil By-Products and Natural Gas and Their Transformation Products) and Their Protection Zones which set restrictions on activities which can be carried out in 3 physical zones of proximity to the operating pipeline.

A pre-construction survey will be undertaken to record the condition of access roads, laydown areas, rail offloading area and any special features along the pipeline ROW before construction to inform re-instatement work (17-14).

5.2.9 De-oiling and Nitrogen Generation Sites

Temporary nitrogen generation units, compressors, pumping equipment and pig traps will be required at strategic locations in order to bulk de-oil the WREP pipeline sections. These locations will be determined in detailed design, but are anticipated to be selected from the below locations:

- PS11
- PS13
- BVS 26
- BVS 27
- BVS 28
- PRS1
- PRS2
- BVS 44
- Supsa WREP HDD entry and exit sites
- Supsa Export HDD entry and exit sites
- Supsa terminal
- Tie-in sites for each re-route section.

Where the existing facilities in the above list have suitable pigging and/or pumping facilities, these will be used in place of temporary equipment.

The overall strategy for selection of de-oiling sites is to maximise the safety of the de-oiling operation. The Project is currently evaluating the pressure limitations on the existing pipeline, which will influence the selection of de-oiling sites.

5.3 Design Basis

5.3.1 Design Life

The new sections of pipe will have a 25-year design life, which is the same as the sections that were installed between 1997 and 1999. Routine maintenance measures will be applied to help all facilities operate as designed for their intended lifetime.

5.3.2 Codes and Standards

The primary code applicable to the design, construction and operation of the new pipeline sections is ASME B31.4 – Pipeline Transportation Systems for Liquid Hydrocarbons. This will be supplemented by other selected international standards (e.g. American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), British Standards Institute (BSI) and International Standards Organisation (ISO).

Relevant BP Group Engineering Technical Practice documents will also apply.

5.3.3 Design Pressures and Temperatures

The design pressure for the new pipe will be 80 bar g and will not be less than the maximum allowable operating pressure (MAOP) to provide safe limits on the design of the pipeline system. The replacement works remain within the original hydraulic envelope so no change will be imposed by the WREP-SR Project. The pipeline and facilities will be operated within the intended design conditions (OP01).

The replacement sections have been designed for a buried temperature range of minus 10°C to plus 50°C.

5.3.4 Pipeline Diameter and Materials

The new sections of welded steel pipe will conform to grade API 5L PSL2 (X52) and will have nominal wall thicknesses to meet the design code requirements (Table 5-3).

Table 5-3: Pipe Dimensions

	General Pipeline	Major road and river crossings	Supsa Export crossing
Nominal External Diameter	530mm	530mm	914mm
Nominal Wall Thickness	9mm	10.3mm	15.9mm – under river 12.7mm – between river and tie-in
Grade	X52	X52	X52

The pipes will be coated externally with a three-layer polyethylene coating system (3LPE). Field joints and factory-made bends will be field coated with specialist epoxy coatings.

5.3.5 Cathodic Protection

The re-route sections will be protected from corrosion by an impressed current cathodic protection system (D5-001) that will be integrated into the existing WREP protection system. No additional anode beds are anticipated.

5.3.6 Separation Distances

The WREP-SR sections are generally not parallel to the existing WREP pipeline because they are designed to avoid landslides on the existing WREP pipeline route.

Where the WREP-SR sections are parallel to existing GOGC pipelines, 10m separation is provided in accordance with Document L51861, Line Rupture and Spacing of Parallel Lines, prepared by Pipeline Research Council International (2002). This separation distance will protect the GOGC pipeline from damage during construction and protect the WREP pipeline in the unlikely event of hydrocarbon release from the GOGC pipeline.

5.4 Construction Activities

5.4.1 Construction Overview

Pipeline construction is a sequential process and comprises a number of distinct operations that are undertaken by a range of specialised and general crews. Pipeline construction will occur simultaneously at more than one location to make efficient use of the workforce and machinery, to meet programme requirements and work within constraints imposed by seasonal weather. There will also be specialist teams installing the major crossings and special sections, undertaking the de-oiling and tie-ins.

The minimum burial depth for the new sections of pipe will be 1.0m to the top of the pipe. All crossings will have an increased burial depth and protection measures (see Section 5.4.13).

It is anticipated that the range of average pipeline lay rates will be between 24 and 200m/day/crew. Lay rates, however, are highly dependent on site-specific factors (e.g. ground conditions, topography, restricted areas or pre-existing infrastructure) and weather conditions. The sequencing of the construction activities will be planned to minimise the impacts of weather and achieve the overall Project schedule.

The construction works will be conducted in accordance with the HGA and applicable government regulations, contractual requirements, applicable permits and authorisations, and Project-approved drawings, plans, procedures and specifications. However, within this regulatory framework, the selection of many of the detailed construction methodologies and plant for the WREP-SR Project will be the responsibility of the successful construction contractor(s). As such, much of the more detailed approach in terms of construction methodologies has yet to be defined; however, these will meet the requirements defined in Project-approved specifications and drawings, and be monitored by company representatives on-site. This section aims to present an indicative outline of the approaches that are likely to be adopted by the construction contractor(s), recognising that some details may change at a later stage of the Project.

Before commencement of each element of the construction programme, the engineering and construction contractor(s) will develop detailed designs, drawings and method statements for the work to be performed. These documents will incorporate the reasonable requirements of landowners and occupiers; the mitigation measures outlined in this ESIA; and the requirements of BP and the regulatory authorities in Georgia.

Construction is expected to involve the following main activities, which are described in this section:

- Improvement of access tracks/roads where necessary
- Right of way preparation
- Delivery of materials and personnel to site
- Pipe stringing and cold bending
- Trench excavation
- Installation of line pipe
- Open-cut crossings of minor irrigation canals, watercourses, tracks, roads, services etc.
- Installation of river crossings by trenchless (HDD) method (Supsa river)
- Hydrotesting and pre-commissioning of the new pipeline sections
- Installation of cathodic protection systems
- De-oiling of replaced sections
- Tie-in of the new pipeline sections
- Cleaning and removal from service (decommissioning) of the redundant pipeline sections
- Reinstatement of all disturbed areas.

An indicative layout for the construction ROW is provided in Figure 5-1.

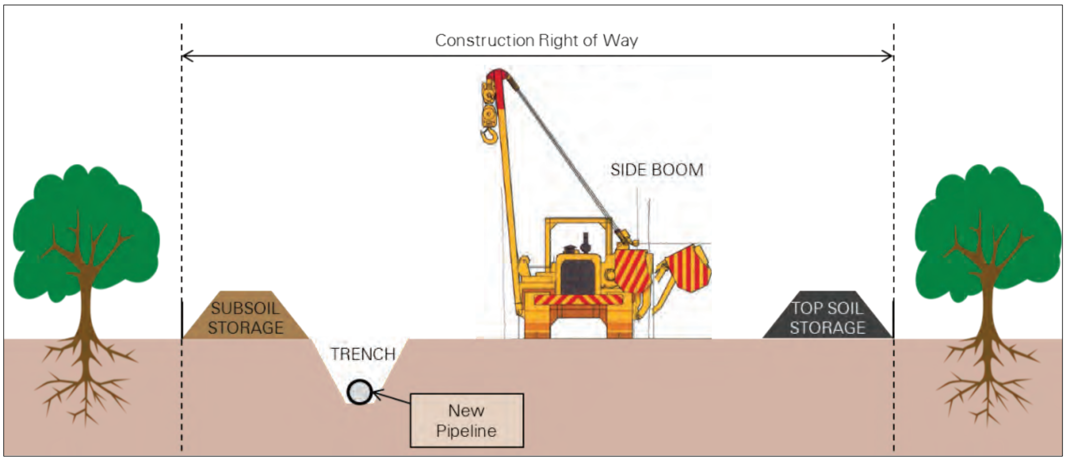


Figure 5-1: Indicative Layout of Construction Right of Way

5.4.2 Construction Schedule and Workforce

On the basis of the current planned schedule, mobilisation is planned for late 2016, and construction activities are scheduled to start in 2017, with de-oiling and removal from service of the redundant sections taking place during 2018 (see Figure 5-2).

The peak workforce will be approximately 350 people but the manning levels will vary considerably during the course of construction.

Activity	2016	2017				2018			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mobilisation	■	■							
Preparation works			■						
Pipeline construction				■	■	■			
River Supsa crossings				■	■	■			
Pipeline de-oiling and tie-ins							■	■	
Removal from service								■	■
Bio-restoration								■	■

Figure 5-2: Provisional Construction Schedule

5.4.3 Workers' Accommodation and Pipe Storage Area

Facilities will be needed for pipe storage, mechanical maintenance, fuelling, warehousing, project offices and worker accommodation during construction. Construction workers will be accommodated in local hotels and guest houses and/or their own accommodation, thus a dedicated construction camp will not be required. Where possible, the Project will utilise existing industrial sites for pipe storage pending delivery to the ROW.

5.4.4 Access Roads and Tracks

The road conditions in some areas of Georgia are poor, with defects ranging from minor cracking of surface materials to significant potholing, and, in some cases, severe degradation. To give adequate and safe access for equipment, materials and personnel to the construction sites and permanent facilities, some existing roads and tracks may need to be upgraded.

Most roads have been evaluated for cultural heritage, ecological and social sensitivity (see Table 5-4 and Chapters 7 and 8); no widening will be undertaken or passing places created at locations that are ecologically sensitive, are known to have cultural heritage interest or would directly affect residential properties. Any access road proposed by the Contractor as an alternative to the ones listed in Table 5-4 will be subject to an environmental and social assessment, which will be submitted by Contractor for Company approval. If there is a need for additional land take outside that described in the ESIA the relevant authorities will be consulted and environmental and social assessments will be undertaken if required to obtain the relevant permits and consents (39-01).

Eight new sections of road will be required, as described in section 5.2.3. Drainage ditches will be included where necessary to reduce erosion/flooding of the road or adjacent land by rain or snow-melt (3-37).

The access roads used by the Project will be subject to routine maintenance during construction to keep them in a satisfactory condition to allow ROW entry for construction equipment, construction and inspection crews, pipeline operations and security staff.

Any maintenance works will be planned to achieve minimal interruption to local road users. Following construction, the Contractor will repair roads to at least their pre-construction condition. For roads that have been upgraded, the Contractor will submit a close out report for Company approval (37-07).

Table 5-4: Proposed Access Roads

Access road	Total length (metres)	Length (metres)/Category		
		3 Local bound	4 Local unbound	5 New build
AR BVS26 (AM46.4)	route to be confirmed	-	-	-
AR52	1088	-	209	666
AR54	1151	-	1151	-
AR55	676	-	676	-
AR55a	544	-	544	-
AR63	2926	-	2926	-
AR63a	2787	-	2787	61
AR64.5	1140	-	1140	-
AR64.5a	370	-	334	36
AR65	1559	-	1559	-
AR65a	1534	-	1534	-
AR66	725	-	725	-
AR66a	902	-	688	214
AR67	3117	-	3117	-
AR69	0	-	-	-
AR69a	2397	-	2397	-
AR69b	64	-	64	-

Access road	Total length (metres)	Length (metres)/Category		
		3 Local bound	4 Local unbound	5 New build
AR-BVS28 (at AM72.75)	221	-	221	-
AR to PRS1	13010	13010	-	-
AR223	7079	4490	2589	-
AR225	6873	-	6608	265
AR225.5	264	-	264	-
AR372	122	-	96	26
AR373	1954	481	1070	402
AR374	58	-	-	58
TOTALS	50,561	17,981	30,699	1,728

5.4.5 Pipe and Equipment Transport to the ROW

It is anticipated that the sections of pipe will be transported from the pipe-fabricating/pipe-coating factories into Georgia via the port of Batumi or Poti on the Black Sea coast. Pipe is likely to be transported from Batumi or Poti to Tbilisi by rail, with transport by road to the Supsa river crossing and section RR-004a.

Pipe will normally be offloaded directly onto rail cars at the port and secured with dunnage and strapping to prevent damage to the pipe coating during transit to rail sidings close to the main storage site. Mobile cranes will be used to offload pipe sections from the railcars to storage areas or pipe trucks at rail sidings in East Georgia.

Although some of the pipe sections may be transported directly to the ROW, it is likely that most will be stored initially in a temporary pipe storage yard. From the pipe yard, pipe sections will be transported to the ROW on trucks that will travel along the approved access routes. It is anticipated that there will usually be 9-10 pipes on each truck, resulting in the order of 150 truck movements to take pipe from the temporary pipe yard to the ROW.

Some of the plant needed for pipeline construction will have to be imported temporarily into Georgia for the construction works. It is likely that this equipment will follow the same logistical routes as the line pipe by either road or rail.

5.4.6 Right of Way Preparation

Setting out/staking of the pipeline route

The ROW and any additional temporary workspaces will be surveyed and set out (i.e. marked out and, where necessary, fenced off). The Contractor will be required to keep within the designated footprint (30-23). Existing third party services and sensitive receptors that need to be avoided during construction (e.g. cultural heritage sites or specific trees which are to be retained) will be marked (D5-045).

At certain locations (see Section 10.7) experienced ecologists will work with the construction contractor(s) to identify, lift and translocate rare plants before construction begins.

Warning posts and bunting will be erected to mark overhead cables, and temporary crossing points (30-17).

Surface preparation and grading

The pipeline route will be cleared and graded to permit the safe installation of the new sections. This process will include the removal of trees, scrub and other surface vegetation, removal and storage of the fertile top layer of soil and levelling (‘benching’) of the ROW in sloping ground.

Vegetation clearance work will be undertaken using chainsaws and earth-moving equipment.

The topsoil will be stripped across the working width by appropriate earth-moving equipment and stored on the ROW. After topsoil stripping, plant and vehicle movements will be confined to the underlying subsoil.

Excavated subsoil will be stored on the ROW or in agreed temporary storage areas; if disposal is necessary, it will be transported to an approved disposal site (1-11), in accordance with the Project Waste Management Plan (see Section 5.8.6). At locations where work is planned close to an operational pipeline, the spoil may be stored over the live pipe to provide the necessary working width and additional protection during construction.

Excavated subsoil and topsoil will be segregated and stored in free-draining stacks outside the running track to avoid mixing or compaction by construction plant/vehicles (4-02).

Surfaced roads and paved areas that are subject to open trench crossings will be prepared by removing material only directly over the width of the pipe trench. This material will be kept separate from other stripped or excavated material.

At watercourses, bank and bed material will be stored separately, away from the active channels and will not be placed where flow or drainage will be obstructed (3-23).

Construction design of river and stream crossings will take account of the use requirements of downstream communities and will seek to ensure minimal interruption to flow by using measures such as pumping, channel diversions and fluming (11-01). The Contractor will aim to maintain the integrity and viability of functional irrigation and drainage systems throughout construction by using measures such as pumping, channel diversions and fluming. Any deviations shall be subject to approval by the Company (35-06).

5.4.7 Pipe Stringing and Bending

Pipe sections will be transported to the ROW and laid out offset from the centreline where possible (see Figure 5-3). Following consultation with local communities, gaps will be left in soil stacks and pipe strings at strategic locations to allow passage of people, wildlife and livestock where the Project considers it safe to do so (20-01).

Factory manufactured bends will be used for acute changes of pipe direction or elevation along the route. Less severe bends will be formed using pipe-bending machines in the field or laydown area. The quality of the bends will be controlled by approved bending procedures, witnessing trial field bends before production and inspection of completed field bends.

Figure 5-3: Typical Pipeline Stringing

5.4.8 Pipe Welding and Inspection

Following stringing and bending, the pipe sections will be elevated onto wooden blocks (skids) or mounds of earth to the correct height to allow proper alignment of the sections and safe welding. Internal clamps will be used to align pipe lengths. A welded pipe section is shown in Figure 5-4.

Welded pipe will be inspected to API 1104 plus additional company requirements. Welds will be visually inspected initially, then subject to 100% radiographic or ultrasonic inspection. In addition, the following non-destructive tests (NDT) will be performed on specific welds by the inspection teams:

- Ultrasonic testing
- Magnetic particle inspection (MPI)
- Dye penetrant inspection (DPI).

NDT inspectors will be suitably qualified (i.e. to level II of the relevant PCN standard or ASTM-TC-1A standard).

Rejected welds will be repaired or replaced as necessary, in line with company specifications, and re-inspected. To minimise the number of tie-in welds below ground level, the pipe will be welded into the longest practicable strings at ground level before being lowered and connected to the mainline. These strings will take into account third-party access requirements across the ROW and will generally be limited to no greater than 1000m long. Further limitations on maximum string length will be enforced in sloping terrain.

Figure 5-4: Welded Pipe Section

5.4.9 Field Coating

The line pipe will be supplied with a factory-applied three-layer HDPE coating. Field coating will be applied to all welds, fittings and areas where the factory coating has been damaged to provide a continuous coating along the pipeline. Following welding, the joint area will be grit-blasted and a liquid epoxy coating will be applied. The coating thickness will be tested after application and then, immediately before lowering, checked for pin holes by electrical continuity tests.

5.4.10 Trenching

The trench will be dug to a depth that allows pipeline installation with a minimum of 1m of cover from the top of the pipe to the pre-existing ground surface. The presence of sub-surface structures (e.g. other pipelines) or surface features such as roads and watercourses will require deeper installation of the pipeline at these locations. Where the WREP-SR pipeline crosses buried services or pipelines, trenchless or open cut crossing methods will be adopted. A minimum typical vertical separation between the WREP-SR pipeline and the existing service or pipeline will be 1500mm where trenchless techniques are used, and 900mm where open cut techniques are used (D5-010). A typical service crossing is shown in Figure 5-5.

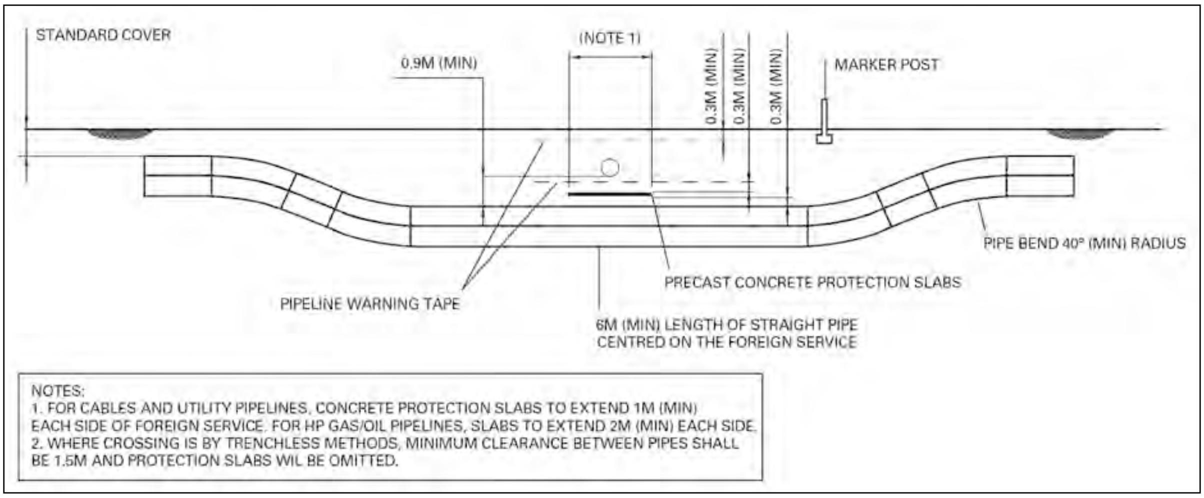


Figure 5-5: Typical Service Crossing

The trenching operation will be undertaken using methods to suit the local terrain and ground conditions. Trenching equipment will include backhoes and rippers, with rock hammers used in areas of rock. As an option, the contractor may also elect to mobilise trenching machines and deploy these on specific sections of pipeline. Based upon the results of geotechnical investigations the use of explosives is not envisaged. In confined areas, such as adjacent to existing pipes, a combination of backhoes and hand tools will be used to open and reinstate the trench.

The length of open excavations will be restricted to 3km of continuous trench in any one section (21-01). Where the ROW is near settlements, measures will be taken to limit public access to the ROW or excavated trench (see Chapter 10).

If water accumulates in the open trench (either from rainfall or because of a high water table), it will be pumped out before the pipe is lowered into the trench (3-34). When discharge velocities have the potential to create erosion, energy dissipaters will be used to establish sheet flow. Trenches will be dewatered in such a manner that no heavily silt-laden water flows into any wetland or water body (3-30). The use of silt fences, sediment pits or similar methods will be employed as and when appropriate.

Safe trench crossings will be constructed at locations where public access is needed across the excavation. Warning signs and barricades will be erected around the trench; adequate warning lights will be provided during the hours of darkness.

Following excavation, the trench will be prepared to accept the pipe. Rocks or debris that could damage the pipe coating will be removed from the trench. Some excavated material will be screened to remove rocks and placed in the bottom of the trench as a layer of soft padding. Where excavated material is unsuitable for padding or backfilling, padding materials (e.g. sand or small-grained soils/gravel materials) will be bought or sourced from approved borrow pits (see Section 5.2.5).

5.4.11 Lowering-in and Backfilling

After pipe joint coating and testing, sideboom tractors will be used to lift the pipe section and lower it into the prepared trench. Several sidebooms will work simultaneously to accomplish the lowering-in procedure (see Figure 5-6).

Figure 5-6: Lowering-in of the Pipeline

Where the pipeline crosses watercourses, the pipeline will be protected by concrete. In the case of larger crossings, concrete coating will be applied to the pipe with pre-cast slabs being provided at ditch crossings.

The trench will be backfilled with the material taken from the trench, in the reverse order to which it was excavated, and will be consolidated by compacting in layers. This process helps ensure that appropriate compaction of the material in the backfilled trench is achieved and reduces the risk of future settlement, washout and erosion. Care will be taken to remove organic debris, such as vegetation and branches from backfill materials.

In sloping terrain (usually 10 degrees and above), trench breakers (e.g. bags filled with sand/ cement mix) will be installed across the width of the trench at suitable intervals up to the graded ground level (D5-065). These act as barriers to subsurface water flows that could channel through the pipe trench, washout the backfill material and potentially expose the pipeline.

Any surplus subsoil from trench excavations will normally be spread within the working width and within zones that exhibit similar subsoil types. The spreading work will be carried out in a manner that avoids the mixing of soil types to the greatest extent possible (D5-066). Trench spoil will be spread evenly beneath the topsoil and not left on the surface (1-12). Where off-site disposal is necessary, it will be disposed of in conformance with the Project Waste Management Plan (see Section 5.8.6). Where any pre-existing land drains are cut or affected by the construction works they will be restored as part of the backfilling operation.

5.4.12 Ridge and Slope Installation

At some locations the new pipe will be installed within the crest of a ridge for a proportion of the route. The existing pipeline will be accurately located and, where adjacent, marked before the top of the ridge is levelled to create a working platform. Excavated material will be placed above the live pipeline to provide extra protection from construction plant. A trench will be excavated at least 3m from the existing pipeline and sections of pipe will be lowered in for welding. Where practical, short strings of pipe (two or three joints long) will be welded together at a nearby location where space is less congested. The construction contractor(s) will be required to produce detailed method statements for each ridge section, for approval by BP. The method statement will include analysis to maintain the integrity of the old and new pipelines during construction, reinstatement and operation. Following installation and backfilling, any surplus spoil will be removed from the area for appropriate reuse or disposal in accordance with the Project Waste Management Plan (see Section 5.8.6). It will not be side-cast below the ridge and into the valley below. An indicative layout for installation along a ridge is shown in Figure 5-7.

Where construction is on very steep slopes, construction methodology will be modified to help ensure safe working conditions. This will include provision of winching machinery and cables for anchoring of machinery and transportation of fabricated pipe strings. Erosion control measures will be installed on ridges and side slopes as required by the Project Reinstatement Specification (3-35).

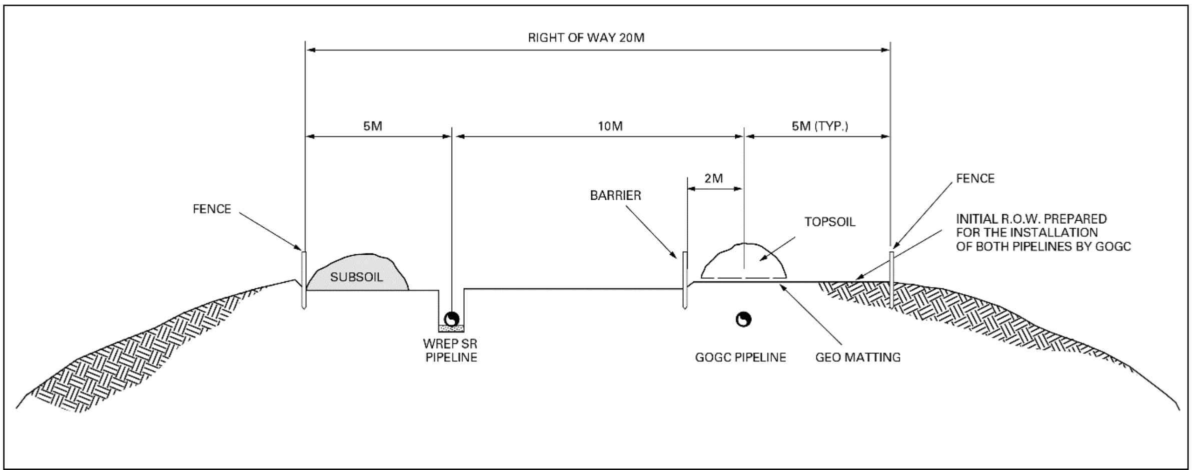


Figure 5-7: Indicative Layout for a Ridge Crossing

5.4.13 Crossings of Linear Features

Crossings are defined as the intersection between the proposed pipeline route and pre-existing features such as watercourses, roads, tracks and underground services. Pipeline installation techniques for such crossings are discussed in this section. The intention is to use an open-cut technique for all crossings, except the two R. Supsa crossings. The Supsa river crossings will be constructed using horizontal directional drilling (HDD). Relevant methodologies are described below.

Watercourse crossings

The watercourse crossing design philosophy is that:

- The pipeline will remain fully buried outside the predicted river active zone (the zone of potential lateral and vertical movements) for the pipeline design life
- The pipeline will not be exposed during at least a 1:200 year storm event
- Each major river crossing will have a site-specific design which will be set to account for the expected maximum flow rates (1:200 year storm event), sediment movement patterns, anticipated changes to the river bed contour and the predicted extent of lateral erosion (D12-06).

The major river crossings (i.e. the Supsa crossings) have been designed in accordance with the process below:

- Hydrological analysis and hydraulic modelling (as appropriate depending on the underlying geology at the crossing)
- Acquisition of geotechnical information
- Prediction of extent of the river active zone
- Study of any current third-party activities and/or infrastructure within the vicinity of the pipeline crossing that could affect the river flow and pattern
- Review of the existing river crossing monitoring reports carried out as part of the operation of the WREP
- Determination of minimum depth of cover below the river and horizontal extent of crossing
- Determination of the appropriate crossing technique
- Determination of the need for any additional pipeline protection works to control the active zone of river movement thereby protecting the installed pipeline.

The two Supsa river crossings exhibit widespread evidence of lateral movements (with bank erosion and collapse) and vertical instability, with continuing deepening and, in the most severe cases, head-cutting (in which a step in the channel bed moves upstream as the face of the step is eroded).

Over the last few years both of the Supsa crossings have been significantly modified by BP Operations in order to reduce the risk of exposure and potential rupture of the existing pipeline. Modifications have included the installation of revetments and barrages. These protection works have a significant impact on the characteristics of the watercourses. Whilst they provide short to medium term protection, they cannot provide the long term integrity needed. The most robust and safe way to ensure that exposure and possible rupture cannot occur at the Supsa crossings is to replace the pipeline crossings and avoid the calculated active zone. Both Supsa crossings have an estimated vertical erosion of between 6-15m below the lowest point of the river bed, the depth depending on location, over the total active width.

Technical studies have been undertaken to determine the active zone of the Supsa river, as summarised in the box below. The proposed profile of the HDD is deep and well below the identified active depth and outside of active width. The replacement sections will therefore not be affected by scour or riverbank erosion.

Key sources of data relating to the anticipated geotechnical conditions likely to be encountered during the construction of the two HDD crossings of the River Supsa

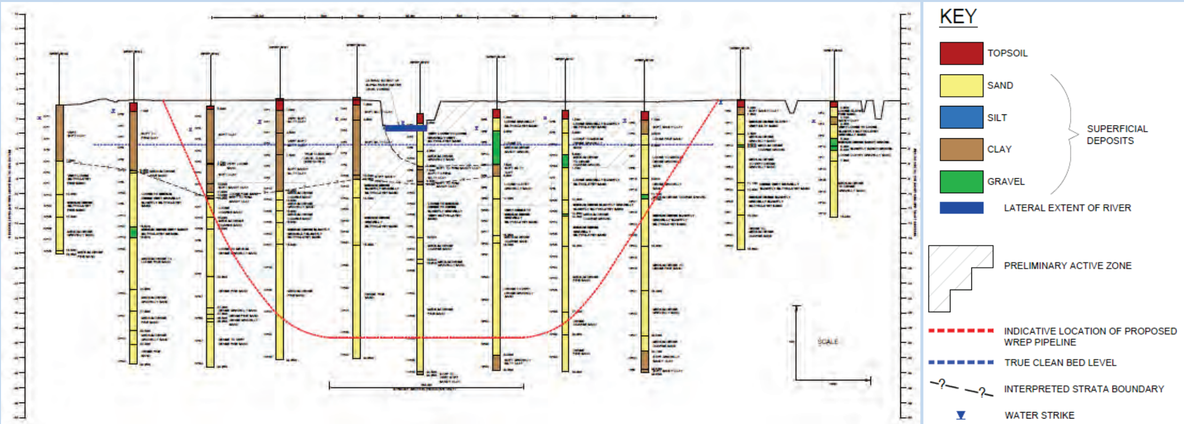
1. Active Zone Report for WREP SRP

This report provides a detailed assessment of both lateral and vertical scour risk for both Supsa crossings. It includes an assessment of predicted vertical scour for a range of flood events including the 1:200 year event. The assessment was used to define the active zone (depth and width) that a new pipeline must avoid in order to ensure the integrity of the pipeline. It should be noted that the calculated vertical scour associated with a flood event is only one of five components which need to be considered when defining the maximum vertical active depth.

2. Supsa 1 River Crossing, Georgia – Geological and Geotechnical Review Report

This report provides a comprehensive assessment by a specialist geotechnical company (Atkins) on the geological and geotechnical conditions present at the Supsa WREP HDD crossing site. It examined the soils data recovered from 11 boreholes; based on this raw data and their geotechnical expertise Atkins developed a geotechnical model for the site. The embedded cross sectional drawing in Appendix A provides a good representation of the expected soil stratigraphy and lithology at the crossing site.

3. Supsa 1 River Crossing HDD Crossing Profile

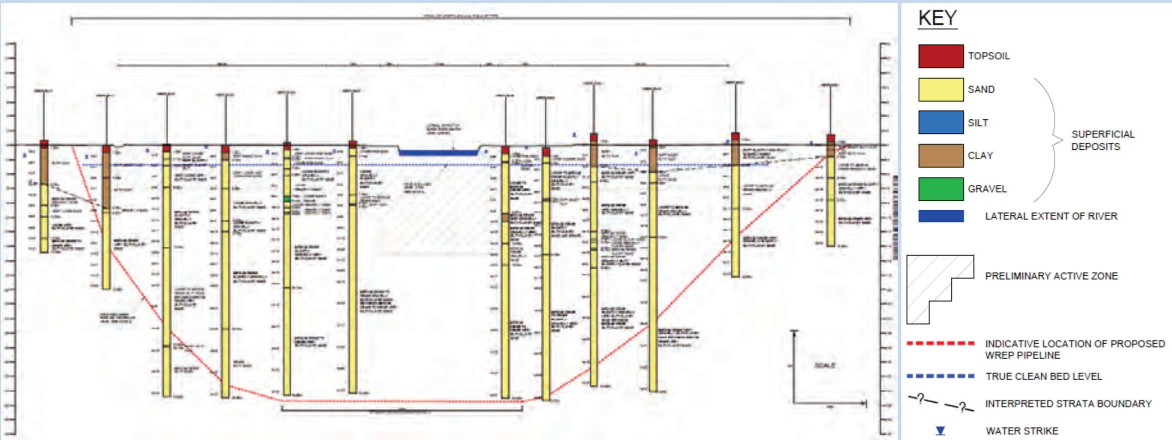


This drawing shows the assessed active zone (active depth and active width) which the HDD alignment will avoid.

4. Supsa Export Pipeline River Crossing, Georgia – Geological and Geotechnical Review Report

This report provides a comprehensive assessment by a specialist geotechnical company (Atkins) on the geological and geotechnical conditions present at the Supsa Export Pipeline HDD crossing site. It examines the soils data recovered from 12 boreholes; based on this raw data and their geotechnical expertise Atkins developed a geotechnical model for the site. The embedded cross sectional drawing in Appendix A provides a good representation of the expected soil stratigraphy and lithology at the crossing site.

5. Supsa Export River Crossing HDD Crossing Profile



This drawing shows the assessed active zone (active depth and active width) which the HDD alignment will avoid.

With the exception of the R. Supsa crossings described above, all other watercourse crossings along the pipeline route will be based on typical drawings for each crossing type (see Figure 5-8 and Figure 5-9), with additional civil protection measures installed where required, to limit the potential for erosion, which will be validated by specialist river crossing engineers to confirm the final design. The final design will ensure the set-back distance and burial depth are adequate to prevent exposure over the pipeline design life.

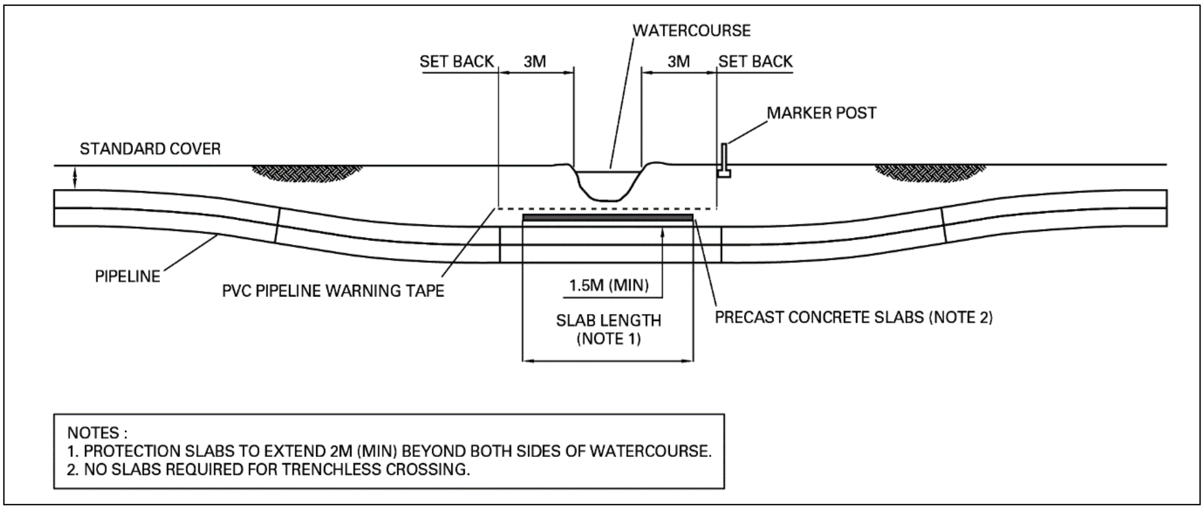


Figure 5-8: Typical Ditch, Stream or Canal Crossing

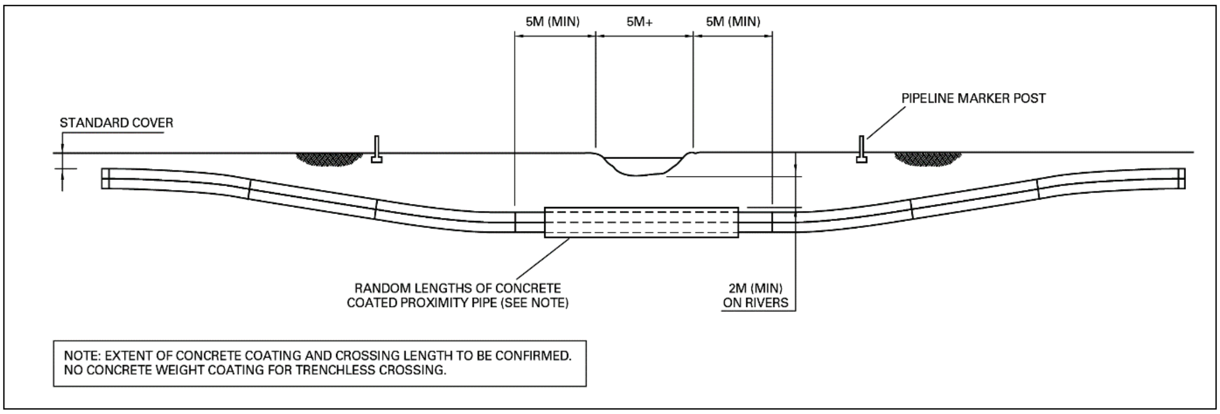


Figure 5-9: Typical Crossing of Watercourse Wider than 5m

Monitoring and maintenance activities will be undertaken at river crossings with the frequency and type of monitoring depending on the river type, crossing technique, burial depth, set-back distance, pipeline protection measures and third-party activities in the vicinity of the crossing. These are described in more detail in Chapters 10 and 12.

On the replacement sections of the WREP the watercourses that have to be crossed can be classified into three types:

1. The river Supsa is a wide, meandering, non-braided river. Two crossings are to be replaced:

    i. The WREP (Baku-Supsa pipeline) crossing will be replaced with a new section of pipe being installed approximately 225m south-east of AM 372, where the river channel is about 80m wide

ii. The Supsa export pipeline crossing will be replaced with a new section of pipe installed c.160m downstream of the existing crossing i.e. c.1630m downstream from the proposed WREP crossing. At this location the river channel is about 125m wide.

The new pipes will be installed using horizontal directional drilling (HDD – see below). There will be a working area (*c*.50x50m) set back from each bank. This section of river is within the Kolkheti lowlands which are characterised by a high water table. It is therefore likely that dewatering and/or pumping will be needed to avoid excessive quantities of water accumulating in the excavations.

2. Within RP-001a and RR-001 there are several deep gullies and streams at the bottom of steep-sided valleys, some of which show extensive instability both vertically and laterally. In the latter case, in particular there are risks of undermining the steep valley slopes and causing failure of the steep banks and possibly to the hillsides. At these locations, the pipe will be laid at least 1.5m below the existing bed with sufficient setbacks to prevent future exposure of the pipe. Reinforcement of the riverbanks by gabions or stone mattresses will be considered where additional protection is necessary.

3. There are a number of farm ditches and irrigation canals. With few exceptions these channels are not prone to severe erosion problems and will be addressed using standard methodology, i.e. the pipeline will slope down to pass under the channel with 1.5m cover and be protected with concrete marker / protection slabs.

The majority of watercourse crossings will be constructed using conventional open cut methodologies as outlined below. The exceptions to this are the two crossings of the river Supsa which will be non-open cut using HDD.

All open cut methodologies assume flowing water or the immediate potential for flowing water during construction. To provide mechanical protection and to provide negative buoyancy and/ or provide mechanical protection to the pipeline, open-cut watercourse crossings will be used in conjunction with either:

- Weighted (usually concrete coated) pipe, or
- A concrete slab, buried in the trench above the pipeline.

The trenching of the watercourse banks and bed will normally be undertaken immediately before installing the pipeline section and the trench will typically be back-filled as soon as possible following pipeline installation. This will minimise environmental impacts to the watercourse.

<u>Open cut crossings</u>

One of the following three methods will be used to form open cut crossings.

Method 1 – flumed crossing

In this method, water flow is maintained using temporary flume pipes installed in the bed of the watercourse:

- The trench line will be prepared by stripping the topsoil from the watercourse banks and ramping them down to allow the safe installation of the pipeline
- Suitably sized flume pipe(s) will be installed. The size will be calculated so that the maximum anticipated flow will not exceed 80% of the flume pipe(s) capacity
- The upstream end of the crossing will be dammed, forcing the flow through the flume pipe(s)

- The downstream end will then be dammed to prevent backflow into the open trench
- Where appropriate, fish and other aquatic life caught between the dams will be transferred downstream of the crossing
- The pipe trench will be excavated below the flume pipes. De-watering and/or trench supports may be used to facilitate safe excavation. If pumps are used, the discharge hose will be directed to an upland area that is well vegetated or through a filtering medium to reduce silt loads, before the pumped water is allowed to percolate back into the watercourse
- Pipe to be installed in the crossing will be welded, inspected and coated at a site near the crossing
- The pipeline will be installed in the trench that will then be backfilled with the excavated material and, where existent, the watercourse's armour bed within approximately two days of pipe installation
- At larger watercourses, trench breakers will be installed in the trench after transition to standard cover to prevent subsurface flow
- The riverbanks will be reformed and profiled in accordance with the Project Reinstatement Plan. The banks will be returned to maintain the pre-construction channel width/ hydraulic capacity
- Erosion control measures (e.g. silt fencing erosion control fabric) will be installed and maintained until the area has stabilised and vegetation is sufficiently re-established (see Chapter 10). Where there is a risk of sediment run-off, sediment interception techniques will be used (e.g. filter berms, silt fences or straw bale barriers)
- The downstream dam, the upstream dam, and the flume pipe(s) will be removed in that sequence once the crossing is complete.

Method 2 – dammed crossing

This method is similar to that described above, except the water is pumped around the trench:

- The site will be prepared as for Method 1 and a dam constructed upstream of the crossing within the approved ROW
- Pumps, intake hoses, and discharge hoses will be installed to pump the water around to the downstream side of the pipe crossing. Pumps will be fitted with grills to prevent fish entering them where necessary and will be provided with secondary containment to prevent fuel spills into the watercourse
- Energy dissipaters will be used to prevent erosion/scour at the downstream discharge point
- Once the pumps have begun diverting water, a downstream dam will be installed to prevent water from flowing back into the working area
- Where appropriate, fish and other aquatic life caught between the dams will be transferred to a point downstream of the crossing
- The trench will then be excavated in a manner similar to Method 1
- The pipe will be installed, the trench backfilled and the whole area reinstated as for Method 1.

Method 3 – wet crossing (or dry crossing, when water is absent)

These are crossings using 'wet' installation by means of an open-cut trench. It is anticipated that this method will be used at the majority of ditches as they are generally dry, small or have low flow. The typical procedure will be as follows:

- The site is prepared as for Method 1
- The river bed material is then excavated (potentially through the running water) and stored separately
- The pipe is installed and the trench is backfilled
- The pipe is protected and the whole re-instated as for Method 1.

Non-open cut crossings

Horizontal directional drilling (HDD) will be used to form non-open cut crossings of the river Supsa.

HDD is generally used at the largest crossings, for example river estuaries, as long lengths can be drilled, subject to the size of the pipeline and soil conditions. Figure 5-10 explains in a schematic way how the HDD operation is performed.

The HDD drill (or "launch") site is set up on one side of the crossing and contains the plant associated with directional drilling. This typically comprises the drill rig, two power units mounted on skids, bentonite storage tanks and mixing tanks, a filter for separating cuttings from the used drilling mud, control cab and ancillary equipment.

Stage 1: pilot hole

The first stage of the HDD is to drill a pilot hole using a drilling rod under the crossing to the end point where it will emerge in the area known as the "receive" pit. As the drilling proceeds, the drilling fluid, comprising water and bentonite or lubricating polymers, is pumped down the centre of the hollow drill rods to the drilling face. This lubricates the drilling rods and picks up cuttings before returning to the surface via the drill hole. The drilling fluid is then filtered to remove the cuttings and returned to temporary storage tanks for reuse. The position and progress of the drill head is monitored and controlled from the surface using electromagnetic detection equipment.

The drill may encounter groundwater as it progresses. If this occurs, the pressure under which the drilling fluid or mud is pumped down the borehole will be controlled to prevent migration into the groundwater and vice versa. Drill fluid usage will be monitored at the surface to confirm no significant losses are occurring.

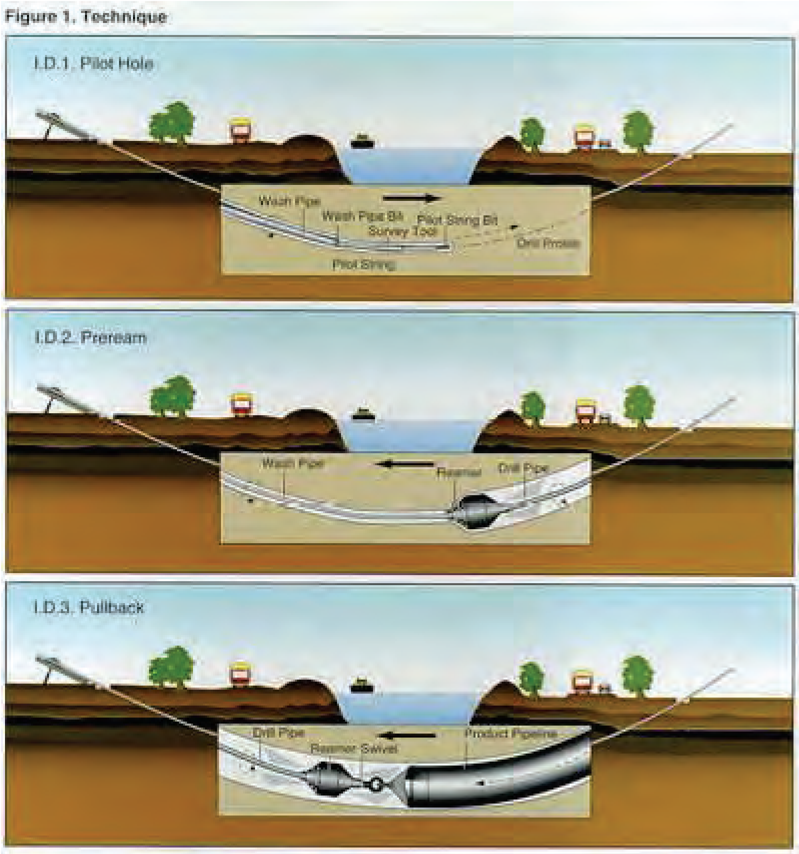


Figure 5-10: Typical Horizontal Directional Drill Operation

Stage 2: pre-ream

After the pilot hole is drilled, reaming devices are attached and pulled back through the borehole to enlarge it to the required diameter.

While the above work is proceeding, the pipe sections are laid out in a straight line (“strung”) away from the receiving pit and welded together.

Stage 3: pull back

When the drilled hole has reached the required diameter, the pipe is attached to the reaming device and pulled through the borehole in one continuous length. This minimises the risk of it becoming stuck during the pull. Bentonite is injected around the reamer to coat the borehole as, being a thixotropic material, it can support the sides of the hole as the pipe is pulled through.

Drilling and pull back operations may be continuous, 24-hour operations.

Once the pipe has been installed, the drilling rig and associated plant are removed. The drilling mud is sampled, analysed and disposed off-site to a waste disposal facility in accordance with the Waste Management Plan.

Road, track and rail crossings

Road crossings will be executed to minimise interruption and disturbance to the local community. Road and track crossings will be designed in accordance with API RP1102.

All road and track crossings will be accomplished by open trenching (Figure 5-11). The pipe to be installed in the crossing will be welded, inspected and coated nearby. One of the following options will then be selected:

- Where it is necessary to maintain traffic flow, only one half of the road will be opened at once, with steel plates used to maintain one lane of through traffic. The completed fabrication will be lowered into the trench during a low traffic period, and one-half of the trench will be re-covered with steel plates to restore traffic flow. The trench will be backfilled in one-half of the road at a time, using a lean-mix concrete or other readily compacted fill.
- Where a suitable temporary traffic by-pass can be identified, the crossing may be installed as described above but with the whole crossing opened at once and without the need for steel plates.
- Following consultation with local officials, residents and relevant landowners, smaller rural roads and tracks may be closed temporarily to through traffic during trenching and installation. This will negate the need for steel plates.

Appropriate signs, barricades and other traffic management measures will be used to minimise road user inconvenience and promote safety during temporary closure of roads.

There will be increased depth of cover at crossings: road crossings will generally be installed with 2.0m cover and unpaved roads will have at least 1.5m cover (D11-02). Concrete slabs will be installed at open-cut road crossings to protect WREP from future road construction activities and excavations along roads or the verges (D11-03).

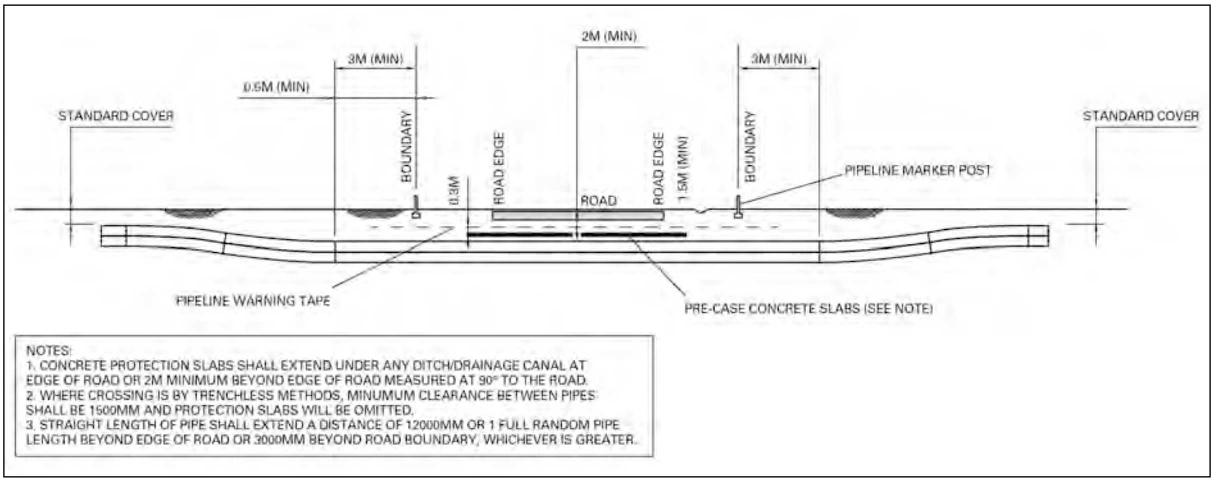


Figure 5-11: Typical Open Cut Road Crossing

Monitoring

Once the pipeline is operational, ROW patrols will monitor river crossings to provide assurance of the integrity of any river protection works and river banks. This will include a visual inspection for river bank erosion or changes to channel morphology. An expert assessment of burial depths, set back measurements and pipeline protection works will be carried out at major river crossings annually (depending on the river characteristics and crossing technique) and after flood events exceeding a 1:100-year return period. Depending on river crossing monitoring results, additional maintenance measures, as deemed necessary by the Project, such as civil protection works which are necessary to maintain adequate depth of cover and set back, will be implemented.

5.4.14 Intruder Detection System

Intruder detection system will need to be replaced for the re-routed sections. To facilitate this, a 40mm diameter duct will be installed above all new sections of pipeline. At the pipeline tie-back points the ends of the duct will be blanked off to avoid ingress of soil or water, coiled and burred.

5.5 De-oiling and Removal from Service of Redundant Sections

5.5.1 Overview

To tie in the new pipeline sections and remove the redundant sections from service, the pipeline needs to be de-waxed, de-oiled and cleaned. The options that were considered for de-waxing, de-oiling, cleaning and removal from service of the redundant sections of the WREP are discussed in Chapter 4.

Temporary pig traps will be tied-in to the redundant sections which will undergo further cleaning runs, as necessary, between the pig traps. Once a redundant section is appropriately clean, it will be decommissioned, left full of air and sealed.

5.5.2 De-waxing

Before the WREP system is shut down, the five sections of pipeline to be replaced with new sections will be de-waxed by operational pigging. This will reduce the amount of cleaning required after the pipeline sections have been de-oiled. Slugs of de-waxing chemical and aggressive brush type pigs may be used.

5.5.3 De-oiling

Secure de-oiling sites will be established at each tie-in location.

For RP-001a, RR-001 and RR-004a temporary break tanks which will be set up at each downstream site. The tanks will be sited within impermeable bunds sized to contain at least 110% of the tank's capacity. The capacity of each tank is unlikely to exceed 20m^3, but 2 or 3 tanks may be required at some of the tie-in locations. Temporary tanks are not envisaged at the Supsa tie-in sites as the oil can be pushed along the pipe into storage tanks at Supsa terminal.

Before each tie-in operation, the WREP pipeline system will be shut down temporarily. Isolation stopples will be installed within the tie-in area at both ends of each new section. For sections RP-001a, RR-001 and RR-004a, oil will be pumped out of the section of pipeline between the stopples into the break tanks and then into the downstream pipeline. For the Supsa river crossings, pig traps will be attached to one end of the section and the oil will be driven into storage tanks at Supsa terminal.

The pipeline will be cut at each isolation point to allow tie-in of the new section of pipe (Section 5.6.2). The redundant section of pipe will be de-oiled and cleaned (Sections 5.5.4) before final removal from service (Section 5.5.5).

5.5.4 Cleaning

A nitrogen generation package and air compressor package will be temporarily located at the up-stream tie-in sites to provide nitrogen to drive the pigs that will displace the oil. It is likely that the de-oiling pigs will be propelled by nitrogen, but the use of compressed air is an option that will be assessed as part of detailed design.

Pig traps will be installed at both ends of each redundant section. De-oiling pigs will be launched to evacuate the line and leave a minimal residual amount of oil in the pipeline. A typical pig train is shown in Figure 5-12. The pig speed will be limited during de-oiling to maintain control and efficient cleaning.

Oil removed by the pigs will be pumped into the temporary break tanks before being injected back into the operational pipeline. The process will be repeated until the pipeline is sufficiently clean. Slugs of cleaning chemicals and cleaning pigs may be used. No water will be used during de-oiling or cleaning thereby negating any requirement for disposal of oily water.

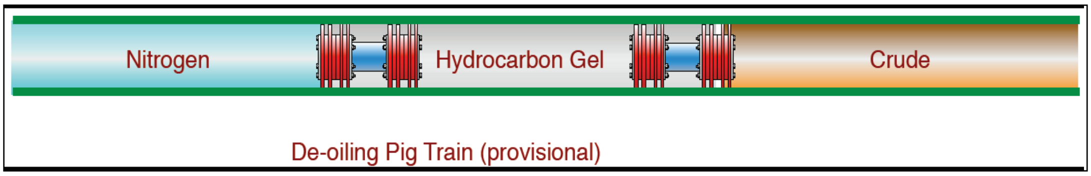


Figure 5-12: Propulsion of Pigs

In order to define the acceptable level of pipe cleanliness, the Project reviewed available international standards and practices and selected the criteria used by the National Energy Board of Canada as the most suitable. These criteria are described as follows:

"No solids or waxy build-up are visible at any point along the pipeline as observed through standard pipe openings such as opened flange or sample connections and the contents have been cleaned out to the extent that no more than a thin oily film on the inside pipe wall surface can be detected by feel or sight."[3]

The level of cleaning will be checked by inspection of the internal pipe wall using coupons associated with hot taps and boroscopes. Where this is not practical, e.g. at river crossings, a swabbing pig will be run through the section for confirmation. Cleaning of each pipe section will be continued until GPC accept that the intent of the above guideline has been met.

This will be followed by physical inspection of the internal wall at selected low points once the pipe has been de-pressurised.

5.5.5 Removal from Service and Maintenance

The redundant sections will be left *in situ*, sectionalised, grouted at specific locations (e.g. major road and rail crossings) and left full of air. An exception to this is the Supsa river crossings where the pipe beneath the river will be left *it situ* but filled with water. An environmental risk assessment has been undertaken to check the validity of this approach (see Chapter 12).

After cleaning each individual section that is removed from service will be visually examined to check that it is sufficiently clean to permit removal from service. If further cleaning is required, it will be undertaken using the previously described temporary pig traps and break tanks.

Within redundant sections of RP-001a and RR-001 include repair sleeves which will contain residual volumes of oil (estimated to be approximately 26 litres per linear metre) trapped between the pipe and the sleeve. The repair sleeves will be cut out to remove the risk of pollution from the entrained oil, and the ends of the remaining pipe will be plugged. In some exceptional circumstances, sleeves may be left in place if such intervention is outweighed

[3] Pipeline Abandonment – a Discussion Paper of Technical and Environmental Issues, 1996.

by environmental damage caused by the physical removal activities. Removal of the sleeves will be undertaken by BP Operations after all other works are complete. It is anticipated that this work will be completed over a three year period.

At road crossings, and locations that are sensitive to ground subsidence, the redundant pipe will be left in situ and filled with grout.

The rest of the abandoned sections will be sectionalised by using welded blank plates or plugs to prevent the pipeline becoming a conduit for preferential water flow and by sleeve removal. The locations of plugs will be based on the results of an environmental risk assessment, as discussed in Chapter 12, but will be at the general locations shown in Table 5-5.

Table 5-5: Proposed Plug Locations

Terrain Feature	Plug Locations
Waterbodies/watercourses	Above top of bank
Long inclines (>200m)	River banks at top and bottom of slope and at mid-slope for long inclines
Flood plains	At boundaries
Sensitive land uses (e.g. natural areas)	At boundaries
Near waterfalls, shallow aquifers, groundwater discharge and recharge zones, marshes, sloughs, peatlands, high-water-table areas	At boundaries and should include an adequate buffer zone
Cultural features (population centres)	At boundaries

Monitoring of potential ground subsidence following removal from service and decommissioning will be performed by routine WREP horse patrols. The Project complaints management system will be used to log any public reports of ground settlement; such reports will be investigated and remediation will be undertaken if the investigation identifies that there is a risk to public or animal safety.

5.6 Testing and Commissioning

5.6.1 Hydrostatic Testing

Testing procedures

Hydrostatic testing of each new pipeline section will involve filling it with water and raising the pressure to a minimum of 1.25 times the MAOP.

RR-001 may be tested in sub-sections to:

- Limit elevation changes, allowing the test pressure to be maintained between the minimum required test pressure and maximum pressure that the pipeline will safely withstand
- Accommodate the maximum stress criteria.

Hydrostatic testing activities will be carried out in sequence and will include the following:

- Welding of certified test ends onto each end of the pipeline test section
- Internal cleaning of pipeline sections using cleaning pigs to remove construction debris
- Gauging pig run to confirm the internal geometry is within specified limits

- Controlled filling of pipeline sections with water
- A temperature stabilisation period to allow the water and line pipe steel temperature to stabilise
- Pressurisation of the pipeline test section
- A test pressure hold period (i.e. commencement of up to 24-hour strength and leak test)
- De-pressurisation of the pipeline test section
- Controlled dewatering of the pipeline test section
- Swabbing of the pipeline test section to remove as much water as practicable
- Removal of test ends.

The displaced hydrostatic test water may be transferred to another section of pipe or discharged at a suitable location. Filters, holding ponds and break tanks will be used to remove any solids and control the rate of discharge. Discharge locations and rates will be agreed in advance with the relevant authorities. If chemical additives have been used, the water will be tested and treated, as required, before discharge to confirm that all discharges are in compliance with applicable environmental requirements. During discharging operations, samples for water quality analysis will be taken and stored for reference.

Following successful hydrostatic testing and dewatering, tie-in closing welds will be carried out to link each new section to the existing WREP pipeline.

Hydrotest water supply

Water for hydrostatic testing will be clean, contain the minimum achievable concentrations of contaminants (e.g. sediment, bacteria) and be non-corrosive. Water abstraction sources will be selected to suit the geographical location of the pipeline and will be of sufficient quantity and quality to facilitate filling of the pipeline test sections without any detrimental effect to the surrounding ecology and downstream consumers.

River flow will be assessed before and during abstraction. Abstraction rates will be based on the results of an evaluation of downstream water usage; and extraction will not exceed 10% of the water flow at any time (15-03). Before extracting water the Project will consider the presence of any IUCN/Georgian Red List fish species particularly during fish spawning season (which normally occurs within the period May to June) and the mitigations such as 10mm fish screens will be determined by a site assessment and approval by the Company (D5-079). Water will be either transferred direct to the test sections by a temporary surface-laid pipe, or taken by road tanker and stored in temporary ponds until sufficient volume is available for the hydrotest. Up to 4,000m^3 of water will be needed for testing. The most likely sources of hydrotest water are as follows:

- Alishkevi River
- Concrete Water Culverts in the vicinity of AM42
- Aragvi River
- Liakhvi River
- Supsa River
- Kvirila River.

Before hydrotesting, the Contractor will prepare, and submit for Company approval, a hydro test plan (10-06). The plan will detail methods to be used for water quality analysis for pipeline filling and discharge, and the environmental controls to be implemented to prevent or minimise the following potential impacts:

- Erosion at intake location (e.g. by using a buoy intake)

- Erosion/scour protection at the discharge location
- Fish entrainment into the pump (i.e. in identified fish habitats)
- Fuel spillage (e.g. secondary containment of pump)
- Inadequate reinstatement of disturbed lands.

All new and existing water abstractions for use by the Project will be subject to an environmental and social assessment to assess potential impacts; decisions on the acceptability of the source and appropriate abstraction rates will be based on the results of the review and in accordance with the abstraction permit (15-02). All necessary permits required for water abstraction and disposal will be obtained from the owner/occupier/local authorities and will be in accordance with Project environmental requirements. The test water will be analysed to check quality before and after use; the use of chemicals will be minimised but it may be necessary to add corrosion inhibitors, oxygen scavengers or biocides. In this regard, chemical additives will be avoided where possible. A risk assessment will be undertaken before any chemicals are added to hydrotest water and prior to the discharge of treated water (10-08).

Drying

Following testing, all free water will be removed from the pipeline.

5.6.2 Tie-in and Re-filling

Each of the new sections of pipe will be tied in to the existing WREP pipeline by golden welds. Oil will then be re-introduced into the system in four sections generally as follows:

- The pipeline sections will be pressurised with nitrogen or dry air
- A pig train will then be launched followed by oil
- Pressure will be maintained in front of the pig train Once each section has been filled and brought up to line pressure the same procedure will be repeated for the subsequent sections until all sections are full of oil
- Normal operation of the WREP will then resume.

5.7 Reinstatement and Erosion Control

5.7.1 Introduction

Before the construction programme commences, the construction contractor will be required to develop a project-specific Reinstatement Management Plan. The full width of the ROW and all other Project areas will be re-instated in accordance with the reinstatement plan on completion of the works. The construction contractor will also be required to incorporate reinstatement measures into relevant method statements for each critical element of the construction programme (e.g. watercourse crossings, site clearance, re-grading). The Reinstatement Management Plan will meet the requirements of Resolution No. 424, dated 31/12/2013 on ‘Removal, Storage, Use and Recultivation of Topsoil’..

The key areas that need full reinstatement are the ROW, temporary works areas and the new temporary access roads.

5.7.2 Reinstatement Philosophy

The Project reinstatement specification is based on the following principles:

- Temporary work areas will be reinstated to near original condition (as compared to pre-construction survey reports or adjacent areas) (17-05)

- There will be a continuing requirement for access along the ROW by patrols and for maintenance
- Levelled working areas on side slopes may be retained to allow future access for inspection and maintenance
- Disturbed areas will be stabilised to protect the integrity of the pipeline and minimise potential impacts associated with erosion, transportation and sedimentation of material from disturbed areas
- Disturbed areas will be re-vegetated to achieve conditions similar to those that exist immediately adjacent to the ROW
- Regular monitoring of all reinstated areas will be undertaken until environmental requirements and goals are achieved.

5.7.3 Erosion Control

An assessment of the route has been undertaken to identify areas of potential erosion and to support the development of appropriate erosion control measures for such areas. Based on the erosion assessment and the technical objectives of the Project, the following goals have been set:

- No risk of exposure of the pipe
- Very low risk of off-site pollution and sedimentation
- Lower risk of damage to bio-restoration by erosion of soils containing seed-bank resources, vegetative material and plants.

Further details of the erosion assessment and the classification of the soils along the route are provided in Section 7.3.3.

Erosion control measures will be implemented at all locations where the erosion class is expected to be above Class 3 (moderate <10t/ha/year), as defined by Morgan (1995). This is a value agreed and adopted on earlier work on BP's pipelines in Georgia. If this is achieved, continuous networks of channels over the slopes will be prevented, ensuring that the depth of material above the pipe is not reduced.

A suite of erosion control measure 'tool boxes' was developed for earlier pipeline repair on the WREP and has proved effective. These erosion toolboxes are methods of erosion control that define the detailed requirements at specific locations and are included on the pipeline alignment sheets. The measures are summarised below and will be implemented along the new sections of pipeline according to the erosion risk at each location:

1. Top soil management
2. Subsoil and spoil management
   - 2 – Standard reinstatement
   - 2S – Special reinstatement
3. Re-vegetation
   - 3G – reseeding
   - 3P – replanting
4. Erosion mats
5. Diverter berms
6. Outlets
   - 1a – low erodible conditions
   - 1b – erodible conditions
   - 1c – for use on made-up ground.

5.7.4 Timing of Reinstatement

Reinstatement will be undertaken once all construction work is complete in that section or area. For the ROW, this will be after the new section of pipe has been tied-in and the redundant section has been capped.

5.7.5 Site Clean-up

Before construction personnel and equipment are demobilised, temporary buildings, equipment, tools and any excess material brought on site or generated during the construction and commissioning programme will be removed (D5-093). Any disposal will be in accordance with the Project Waste Management Plan.

5.7.6 Reinstatement

The first stage of the reinstatement programme will comprise the re-grading of all working areas to achieve a final surface that is sympathetic to the natural landform contours where practical. Any permanent erosion control measures (e.g. diversion berms) will also be installed at this time.

To facilitate natural re-vegetation of the ROW, the separately stockpiled topsoil and vegetation debris will be spread over the surface of the ROW following completion of grading, as appropriate (D5-086). The construction contractor(s) will be required to comply with all requirements for the reinstatement and will be required to submit a reinstatement schedule and plan which, as a minimum, complies with the Project reinstatement specification and the ESIA requirements (see Chapter 10). In some instances, areas of sensitive natural habitats or high erosion potential may be seeded with a mixture of native plant species to facilitate re-vegetation. If considered necessary by BP, additional surface stabilisation measures may be adopted in areas of high erosion potential.

The key reinstatement principles are summarised below:

- Minimise reduction in soil quality and structure through predetermined stripping, handling and storage procedures
- Use of appropriate temporary erosion control measures (including erosion matting, sediment traps, silt fences, and filter berms)
- Use of permanent erosion control (including diverter berms, and trench breakers)
- Reinstate all third party assets affected by Project activities in accordance with pre-entry agreements
- Reinstate all redundant spoil disposal sites. These will be closed, capped and landscaped in accordance with the relevant requirements of the Project Reinstatement Plan and Waste Management Plan
- Reinstate watercourses and locations prone to erosion, as soon as practicable after installation of the pipeline
- Undertake joint inspections of all reinstated areas (i.e. involving construction contractors' reinstatement personnel and BP representatives) to verify that all necessary measures have been undertaken
- Reinstatement of uncultivated areas to facilitate re-establishment of natural (pre-existing) vegetation communities (including, as appropriate, final grading, ripping, cultivating, reseeding and planting of trees and shrubs). Agricultural land will be tilled and left for re-seeding by land users
- Where erosion control seeding is needed, a target minimum cover of pre-existing ground vegetation established within one year of final reinstatement

- An aftercare, monitoring and corrective action programme will be developed and implemented based on examining the bio-restoration process periodically after reinstatement.

Any fences, services, structures, roads, tracks, pavements or other facility affected by the works connected with the WREP-SR Project will be repaired or replaced to a condition that is at least as good as that found prior to construction.

5.7.7 Watercourse Reinstatement

Upon completion of construction works at a crossing, the banks and a surrounding area will be reinstated in a manner that reflects the local environmental conditions. The construction contractor(s) will produce method statements incorporating plans for erosion control, sediment control and reinstatement, before work begins at the crossings (4-12). As a minimum, the method statements will include information on the following:

- Recording of the original channel width, depth and slope prior to disturbance to allow reinstatement as near to the original as is practicable
- Re-contouring of banks to match surrounding slopes
- Installation of erosion protection measures at areas susceptible to washout or run-off. These may include the provision of riprap, gabions or impervious membranes. An ecological survey will be undertaken before any reinforcements are constructed, with appropriate mitigation measures identified and implemented
- Replacement of the channel substrate
- Replacement of the bank topsoil
- Reseeding of the banks.

5.8 Project Resources, Wastes and Emissions

5.8.1 Labour

The construction contractors for the Project will employ approximately 350 Project personnel when work is at its peak. The majority of the workforce will be skilled or semi-skilled personnel. Unskilled positions, such as labourers, will be recruited from the local area. All non-local personnel will be housed in existing hotels or guest houses.

5.8.2 Construction Equipment

The construction works will involve the deployment of earth moving and specialist pipeline-construction equipment. A summary of the estimated mobile and other related equipment needed to accomplish pipeline installation and de-oiling is presented in Table 5-6. It should be noted, however, that the precise type and number of equipment will be determined by the construction contractor(s).

Table 5-6: Major Mobile Plant Items

Phase / Location	Plant type	Estimated number
Construction	Pickup 4x4	15
	Truck7.5 T	3
	Flat bed lorry	6
	Compressor 1300CFM	2
	Grader 14H	2
	Bus 20 men	9

Phase / Location	Plant type	Estimated number
	Excavator 330	9
	Crane 30T	3
	Pipelayer boom 572	6
	Compressor 200CFM	3
	Compressor 900CFM	3
	Wheel loader 966	3
	Dump truck 730	6
	Ambulance	3
	Bending machines 16"-26"	2
	Bending machines 28"-40"	1
	Bomag roller	6
	Quad pay welder	3
	D7 Dozer	4
	Fill pump	2
	Abstraction pump	6
	Submersible pump	6
	Lighting set	3
	Fuel truck (3800 gal)	3
	Generator 70KW diesel	6
	Low boy lorry	2
	Service truck	3
	Tractor and trailer	2
	Water tanker (10 000 gal)	3
	Dozer D8 (and winch)	2
	Static winch 40 tonnes	3
	Mini excavators	4
	Wood chipping machines	4
	4x4 pick-up truck	6
	Rough terrain crane 75T	1
	Test pump	2
	Generator 220kW	2
	Induction coil	3
River crossings (Assuming 1 river crossing undertaken at a time, and the same equipment is used for both (6 month construction time)	HDD rig	1
	100 T Crane	1
	Side boom	5
	Excavators	4
	50 T Crane	1
	Vacuum lift	1
	Testing equipment	1
	Pumps	6
De-oiling	Generators	2

Phase / Location	Plant type	Estimated number
PS11-PS15	Compressors	10
	Site Lighting towers	8
PS13-15	Generators	2
	Compressors	10
	Site lighting towers	8
PRS1 to BV44	Generators	2
	Compressors	5
	Site lighting towers	8
Supsa Export	Generators	2
	Compressors	4
	Site lighting towers	8
Supsa River	Generators	2
	Compressors	4
	Site lighting towers	8

5.8.3 Construction Materials

Estimates for consumption of construction materials are presented in Table 5-7.

Table 5-7: Estimated Resource Requirements for Construction

Resource type	Estimated amount	Units
Line pipe	2,000	Metric tonnes
Aggregates (sand and gravel)	50,000	M^3
Concrete	650	M^3
Asphalt/tarmac	None	
Timber	20	M^3
Fuel/diesel	6,758	M^3
Structural steel	1	Metric tonnes
Coating materials	1,200	M^2
Fibre-optic cable	1,400	Metres

5.8.4 Energy

Diesel fuels will be needed for the operation of all mobile and stationary plant as presented above. These figures do not include fuel that will be used by shipping or rail transportation.

5.8.5 Water

Raw water for sanitary and washing requirements will be sourced from local civil or municipal supplies.

In addition, water will be abstracted from local rivers for hydrotesting the pipeline sections. The total amount of water requirement will depend on the hydrotest strategy. Details of proposed sources are given in Section 5.6.1.

5.8.6 *Wastes and Emissions*

The construction project will generate inert, non-hazardous and hazardous wastes during construction and commissioning. Operation of the pipeline will not result in any additional wastes over and above those generated by the existing WREP system.

The principal wastes and emissions that will be generated during the construction, commissioning and operation of the new pipe sections will be:

- Domestic waste (liquid and solid)
- Packaging materials
- Construction plant emissions (e.g. vehicles, generators and pumps)
- Delivery vehicle emissions (bringing people and materials to site)
- Oils/lubricants
- Vegetation and fencing materials from ROW preparation
- Excess construction materials
- Excess soil and rock
- Hydrotest water and chemicals
- Waxes and oils from pipeline de-oiling and cleaning
- Some old pipe that is removed from service, although most will be left *in situ.*

All waste will be disposed of in accordance with the Project Waste Management Plan.

Before the construction programme commences, the construction contractor(s) will prepare a Project waste management implementation plan that will:

- Identify and quantify anticipated wastes from the construction process
- classify wastes and waste disposal routes in accordance with Annexes I, II and III of the Waste Management Code and with the Resolution of the Georgian Government No. 426 (dated 17/8/15) 'On Definition and Classification of Waste Register by Types and Characteristics' which comes into force on 1st August 2016
- Identify minimisation/collection/storage/treatment/reuse/disposal routes for each waste stream including potential third party re-users
- State the arrangements for properly managing wastes, including training, storage, labelling, transporting and final disposing.

Waste inventory

Table 5-8 presents an indicative and approximate estimate of the hazardous and non-hazardous wastes that will be generated by the Project during construction, de-oiling and removal from service. De-oiling and cleaning will not use water, thereby avoiding the generation of oil water.

Table 5-8: Indicative Waste Breakdown

Waste Type Code [1]	Waste Type	Hazardous (Yes/No)	Property of Hazard [2]	Disposal/Recycling Operations [3]	Basel Convention Code [4]	Pipeline Construction Waste [5]
20 01 08	Food waste	No	—	D 9	—	112 t
20 03 01	Domestic waste	No	—	D 1	—	67 t
20 01 01	Paper/cardboard	No	—	R 5	—	6 t
20 01 39	Plastic	No	—	R 5	—	4 t
20 03 04	Sewage sludge	Yes	H 9	D 1		6,658 m^3
18 01 01	Medical/sharps	Yes	H 9	D 10	Y1, Y3	0.25 t
18 01 04	Medical/bandages	Yes	H 9	D 10	Y1, Y3	0.25 t
17 09 04	Spoil/inert materials	No	—	D 1	—	1 t
12 01 17	Grit blast	No	—	D 1	—	1 t
17 02 01	Waste wood	No	—	D 1	—	30 t
17 04 07	Waste metal	No	—	R 4	—	12 t
08 01 11*	Waste paint	Yes	H 3-B, H 4, H 5, H 6	D 10	Y12	0.9 t
15 01 11*	Pressurised containers	Yes	H 1	D 5	—	1 kg
17 05 03*	Contaminated soil	Yes	H 4	R 10	—	6.63 t
20 01 21*	Fluorescent lamps	Yes	H 6	D 1	Y29	0.8 kg
20 01 33*	Batteries and accumulators	Yes	H 1, H 5, H 6	R 1	Y26, Y29, Y31	0.4 t
15 01 10*	Coating drums (25 litre)	Yes	H 3-B, H 4, H 5, H 6	R 4	Y12	0.04 t
15 02 02*	Oily solid waste	Yes	H 3-A	D 10	Y9	1.6 t
13 02 08*	Oil and lubricants	Yes	H 3-B	R 1	Y9	7 t
16 01 03	Tyres	No	—	R 1, R 5	—	1 t

[1] As per the Resolution of the Georgian Government No. 426 (dated 17/8/15) 'On Definition and Classification of Waste Register by Types and Characteristics'

[2] As per Annex III Defining Characteristics of Hazardous Wastes of the Waste Management Code:

H 1 'Explosive': substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.

H 3-A 'Highly flammable': liquid substances and preparations having a flash point below 21 °C (including extremely flammable liquids), or substances and preparations which may become

Waste Type Code (1)	Waste Type	Hazardous (Yes/No)	Property of Hazard (2)	Disposal/Recycling Operations (3)	Basel Convention Code (4)	Pipeline Construction Waste (5)

hot and finally catch fire in contact with air at ambient temperature without any application of energy, or solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or gaseous substances and preparations which are flammable in air at normal pressure, or substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.

H 3-B 'Flammable': liquid substances and preparations having a flash point equal to or greater than 21 °C and less than or equal to 55 °C.

H 4 'Irritant': noncorrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.

H 5 'Harmful': substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.

H 6 'Toxic': substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.

H 9 'Infectious': substances containing viable microorganisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.

(3) As per the Waste Management Code Annex I Disposal Operations and Annex II Recovery Operations:

D 1 Deposit into or on to land (e.g. landfill, etc.)

D 5 Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)

D 9 Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.)

D 10 Incineration on land

R 1 Use principally as a fuel or other means to generate energy

R 4 Recycling/reclamation of metals and metal compounds

R 5 Recycling/reclamation of other inorganic materials

R 10 Land treatment resulting in benefit to agriculture or ecological improvement

(4) As per Annex I Categories of Wastes to Be Controlled of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal:

Y1 Clinical wastes from medical care in hospitals, medical centres and clinics

Y3 Waste pharmaceuticals, drugs and medicines

Y9 Waste oils/water, hydrocarbons/water mixtures, emulsions

Y12 Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish

Y26 Cadmium; cadmium compounds

Y29 Mercury; mercury compounds

Y31 Lead; lead compounds

(5) Based on a workforce of 350.

Releases to the atmosphere

Atmospheric and effluent emissions associated with the construction activities are provided in Table 5-9 and are based on the type and number of construction plant used and the anticipated duration of each construction activity. Emissions from de-oiling include those from temporary storage in break tanks, refilling the new sections and nitrogen generation.

Table 5-9: Assessment of Total Combustion Emissions (tonnes) from Construction Activities

Source	CO_2	CO	NO_x	SO_2	PM_{10}
Construction spread (non road vehicles)	12,813	103	147	13	19
De-oiling	1,731	9.9	45.1	3	3
River crossings	2,581	22	30	3	4
Road vehicles	1,211	2.33	7	-	0.5

Notes: Emissions based on emissions factors taken from US EPA AP-42 Vol I. Emissions assumed equipment operating continuously for 10hrs per day for a period of 8 months. CO_2 figures calculated from the consumption of 6,144 tonnes (6,758 m^3) of diesel. PM_{10} releases relate solely to combustion engines rather than airborne dusts from other sources. Dusts from such sources are often greater than 10 microns in size.

Fugitive emissions during de-oiling, resulting from the transfer of oil[4] via break tanks, have been estimated using US EPA's TANKS software and in total amount to 0.000537409 tonnes/year methane and 0.239423696 tonnes/year non-methane hydrocarbons (NMHC), These values equate to 0.09399826 tonnes/year CO_2 equivalents.

Waste water

Waste water will be reduced by efficient use of raw water and the implementation of water management schemes that require water to be reused, whenever practicable, prior to treatment and disposal (14-04). All waste water, except for uncontaminated rainwater, will be treated prior to discharge.

Hydrotest water

The maximum theoretical volume of hydrotest water would be equal to the entire capacity of the replaced sections of pipe, i.e. approximately 4,000m^3. Within RP-001a and RR-001 it may be possible to reuse hydrotest water between adjacent test sections, which would reduce the total volume required. Before the testing, the construction contractor(s) will be responsible for the development of a hydrotest water supply, use and discharge strategy that incorporates measures to promote efficient resource usage and appropriate management of the abstraction and disposal of hydrotest water.

To the greatest extent possible, hydrotest water will be discharged, via break tanks and additional filters as appropriate, for reuse in the next section of pipeline to be tested. If necessary, additional water will be added to make up any losses or differences in lengths of test sections. If surplus water is encountered then it will be discharged at approved locations. Prior to the discharge of any hydrostatic testing waters to the environment, the water will be tested and the results assessed in relation to Project standards (see Appendix F). Water will be discharged in a manner that prevents environmental impacts (e.g. scouring, erosion) to land surfaces and/or watercourses.

It should be noted that all water discharged from a pipeline following hydrotesting would be discoloured/stained. Although visible, the concentration of iron compounds (rust) is normally

[4] Azeri Light Crude: http://www.bp.com/en/global/bp-crudes/assays/central_asia/azeri_light.html

very low and can be discharged safely to the environment (i.e. to vegetated ground and then indirectly to watercourse or directly to watercourses). If potential contaminants are found to be above Project standards or are likely to cause ambient water quality concentrations to be exceeded, one of several options for appropriate disposal will be adopted:

- The discharge rate will be controlled.
- The water will be held in an approved holding area (evaporation pond) and allowed to evaporate. The remaining iron residue either will be collected for proper disposal, or, if concentrations are at or below acceptable limits, will be abandoned in place.
- Chemicals (e.g. manganese dioxide) will be added to neutralise the environmental effects of the iron.

Hydrotest water that does not meet the water quality standards for direct disposal will not be discharged directly to the environment. After dewatering and disposal activities are complete, disturbed areas will be restored to their pre-construction conditions.

5.9 Operational Control and Maintenance

The new sections of pipe will be operated as part of the existing WREP. All relevant operating procedures will be updated as necessary to include the new and redundant sections of pipe. As operation of the WREP has been approved by the government through EIA approval, the WREP-SR sections will be operated as part of the WREP system.