

Coastal Zone of the Sochi Re-Gion of Russia -Problems and Perspectives

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Abstract

The modern state of the Sochi region of Russian Black seacoast is parsed in the article from the point of view of beaches stability, efficiency executed of the coastal protective measures, and quality of seawater in the coastal zone. The possible influencing on an environment of engineering measures, foreseen General schema of the coastal and landslide measures on coastal zone of Greater Sochi of 1990 is considered. The offers on organization of complex monitoring of the coastal zone are made.

Index terms— coast zone, integrated coastal zone management, beaches, general schema of coastal protection.

All engineering measures on seashores of Russia (earlier USSR) are carried out within the framework of the so-called General Schema of seashores progressing. For coast zone of the Sochi region in the beginning 1990 years the last version of such General Schema of progressing is developed ([1-4], 1992-1995. The present article is prepared by the writers in addition to the indicated General Schema based on analysis of the existing state of coast.

It was used materials published in the works of modern Russian and foreign research scientists in the management of coastal regions. Information was collected in scientific publications, as well as in open Internet resources. Analyzed reporting metrics provided in the published literature.

This article was used scientific methods, such as the principle of comparison, analysis and synthesis of the results. The article is also based on the principles of objectivity and systematic. This article was used scientific methods, such as the principle of comparison, analysis and synthesis of the results. The article is also a) General information The city of Sochi -representative large in-shore administrative center on the Black Sea coast, which is capturing territory 3,5 thousand km², on which one lives about 400 thousand the person. The common expansion of a land border of the Sochi resort site constitutes more than 133 km with maximum expelling from beaches of the sea on 56 km, sea border -105 km. The Sochi site is a health resort of Federal significance. SPA-hotels, boarding houses, of rest houses and etc. in city. Here is disposed about a quarter of all resort establishments of country for the adult population. Annually more than 1,5 millions tourists direct in this coastal region in summer. More than 900 thousand person simultaneously lived on the territory of a health resort Sochi per separate months of a resort season. At the same time, lump sum holding capacity of existing beaches on a site of the Black Sea coast from Tuapse to Psou is no more than 350 thousand the person (Yu.I.

1 Introduction

ue to the natural resources, the coastal zones all over the world always were and remain most intensively maintained sites. Half of population of the states having an exit to the sea lives at the coastal zones. The migration on coastal region from continental districts is prolonged. In outcome, there is an acute contravention between necessity in immediate consumption of natural resources of the coastal zones and necessity of maintenance of these resources safety on a long-lived outlook. In many inshore sites, including on the Black Sea coast of Caucasus, this contravention already has reached an extreme stage. The considerable proportion of the coastal zone is contaminated; its attractiveness for international tourism is reduced. The fish stocks exhaust. The problem on

45 development of oil and gas fields on shelf, construction of cargo ports and oil terminals is permanently lifted.
46 For stable progressing of the coastal zone, protection and recovering of an environment the acceptance of urgent
47 effectual measures is necessary.

48 This problem in international scale is decided based on development and realization of the dodge of Integrated
49 Management of the Coastal Zones (ICZM).

50 Per the last years, the concern to ICZM has acquired global nature. The realizations of principles and programs
51 on ICZM participate in development both more than 50 countries of a world. In Russia the National report on
52 ICZM, invoked also is prepared to pay attention the President, Government, Legislative power and authorities on
53 places to problems of the coastal zones. Besides major significance for the coastal zones, there is an estimation
54 of environmental impact (EEI) projects of different engineering activity.

55 2 D based on the principles of objectivity and systematic.

56 There is a developed SPA-hotel infrastructure, plenty of Four administrative districts select in city. Historically
57 economy of city developed around of seaport disposed in Central district; therefore, there are district is also center
58 of a SPA-hotels complex and industry is represented in the Fig. 1 The hydrological conditions of the Black sea
59 for coast of Russia are those, that the impurities hitting in the coastal zone, are not distributed in a central part
60 of the sea. They concentrate alongshore. This is promoted by that circumstance that the fulcrum of the basic
61 Black Sea current is apart about 4 nautical miles from beaches, and the drift currents are directional alongshore,
62 irrespective of a wind direction. Hitting in seawater at emergency downthrows the unrefined drains fast are
63 distributed alongshore and in the direction of it owing to effect of nodular carrying. The absence of dodges of
64 impurities carrying by currents can result in to formation of hold-up spots with a high pollutant concentration.
65 The small intensity of water exchange in half-closed coastal dock spaces with the sea, plenty of impurities acting
66 at a coastal zone, makes load.

67 Fig. ?? : The railway and highway driving alongshore with groin system for beaches protection The beach
68 should be considered as complex natural recreational resource, where his geologic-geomorphological basis is
69 indissolubly interlinked to a hydrological mode of the sea.

70 The morphometrical performances of beaches in the Sochi resort region are listed in table 1 (Yu.I. Dreizis,
71 2005. an inshore dock space by area of a high ecological One of the basic recreational factors in Sochi region is
72 a recreational and medical beach. Besides near to beaches is disposed and designed many objects of a cultural
73 and sporting infrastructure: theatres, stadiums, yacht-centers, aqua parks etc.

74 Natural environments of the Sochi region are characterized by an average and low mountain contours, by
75 lithologic complexes of cretaceous and paleogene, concerning high damp and daily average temperatures, which
76 are stipulating the subtropical nature of vegetation. The seismicity of Sochi district is evaluated in 9 balls.

77 It is necessary to point out, that the features and originality of a geological feature of Sochi region (tectonic
78 dissociation, progressing modern downing of beaches, high seismicity, lithologic heterogeneity) promote fissile
79 progressing of sliding processes, destroying of beaches and native born beaches, water logging of the rivers
80 ostium.

81 One of the basic transport mainlines on coast of Black sea coast is the North-Caucasian railway. In the Sochi
82 region on a major extent (about 90 km) it is compelled drives near to the seacoast. Though there are projects
83 of carrying of the railway deep into coasts, they are very problematic, since are interlinked to construction of
84 tunnels, bridges and flyovers on a major extent (Fig. ??, Fig. 4).

85 The beach promotes as progressing of alive organisms in the sea, and represents one of the basic recreational
86 resources involving tourists in marine resort site.

87 The state of beaches (physical and ecological) defines the amount of visits in a health resort.

88 The common necessity in recreational beaches for all districts of the Russian Black Sea coast constitutes 410
89 ha. The Russian sanitary-hygienic norms define the following performances of a beach -0,2 m lengths of shoreline
90 of a beach at its width 25 m on 1 person. It ensures, in the long term till 2020 year, lump sum holding capacity
91 of 820 thousand resting. Thus the common expansion of beaches should constitute about 160 km. Now total
92 expansion of recreational beaches within the limits of the Black sea districts of Russia does not exceed 130 km,
93 and their total floor space is about 354 ha.

94 This floor space powers up a back part of beaches, which one will defend from a water boundary of the sea
95 more than on 25 m, foreseen sanitaryhygienic norms, and closed part, disposed on foreseen spacing interval till
96 both parties from finding here engineering objects (tunnels, marine berths, buffer beaches, building polygons
97 etc.). If to exclude from the common floor space of a beaches it is back and closed parts, the recreational floor
98 space of existing beaches will make all about 259 ha. Let's mark some features of distribution of beaches on the
99 coast. The maximum sizes there is a beach for station Loo, where during 4 km its width constitutes 40-50 m
100 (Fig. ??). As demonstrate introduced data's in the table 1, the expansion of offshore coastal strip in the Sochi
101 region constitutes 113,5 km. About 40 km it is subject to landslide phenomena and up to 20 km is subject of
102 the downfall phenomena (Fig. 5-7).

103 Fi g. 8 : Site of a coast with a free beach of realization of beach protective measures: constructions of the
104 beach protective structures and the addition of mined rock.

105 Average width of a beach from an ostium of the river Shahe up to cape Uch-Dere till 1955 was changed
106 insignificantly. The tendency of its reduction was scheduled per consequent years. It was diminished with 37 up

107 to 29 m to 1985 year. The abatement was scored practically on all extent of this site, but with different intensity.
108 Beaches from an ostium of the river Loo up to cape Uch-Dere there are stable and practically not changed for
109 this time.

110 A beach band from Cape Uch-Dere up to an ostium of the river Mzymta underwent the greatest variations.
111 Average width of a beach on a site was diminished with 30 m per 1914 year up to 19 m per 1955 year. The most
112 intensive fluid wash was supervised in 1945-1963 years. Since 1964 year, due to intensive of a beach addition
113 material, the further fluid wash managed to be stopped, and in consequent and synthetically to retrieve a beach.
114 All sites are entirely built by beach protective structures. The least variations were undergone with a beach
115 between the rivers Mamayka -Sochi. Here after construction of the Sochi port in 1936-1939 years the increase
116 of a beach band till 1950 was scored at the expense of detention of an alongshore current of rubble. The size of
117 beaches were stabilized in the next year. Per the last two decades its fluid wash, however while rather gentle was
118 scheduled. Now practically on all extent of coastal zone from the Sochi port and up to an ostium of the river
119 Mzymta beaches are saved under cover of beach protective structures.

120 The sizes of a beach band between ostium of the rivers Mzymta and Psou for the last decades were not changed
121 almost. It is interlinked that the beach here is in state of nature. The shore on a site from an ostium of the river
122 Mzymta up to cape Konstantinovskiy has receded on the average on 10-15 m for a period 1959-1979 years.

123 Even after accomplishment of measures on recovering natural beaches for the purposes of the wave breaking,
124 their recreational floor space will be augmented all on 65 ha and will constitute about 63% from the indispensable
125 floor space. For today, the total deficit of beaches approximately constitutes on an expansion -31 km; on the
126 floor space -87 ha. The deficit of beaches in borders of Sochi region constitutes 8,8 km on an expansion and 31
127 ha on the recreational floor space.

128 Reduced above data on state of the art of offshore coastal strip testify that the existing beaches do not safeguard
129 beach from shattering effect of surges on a considerable extent. The surplus of recreational beaches is tracked
130 only on rather small sites of considered coast of a health resort within the limits of Sochi region. From cape
131 Uch-Dere up to an ostium of the river Dagomys the size of a beach band are constituted by 10-30 m. Further,
132 on the south up to an ostium of the river Mamayka the beach practically misses. From the river Mamayka and
133 up to an ostium of the river Mzymta width of beaches constitutes 10-30 m and only on separate short sites it
134 constitutes less than 1 m. In district between of the rivers Mzymta and Psou the sizes of a beach band lay within
135 the limits from 25 up to 60 m. It is interlinked to a deficit of a solid drain of the rivers. Per the last years, the
136 intensive withdrawal of rubble from a channel practically of all rivers of locale is supervised.

137 The analysis of dynamics of a beach's width has shown that average width of a beach in 1914 year was peer
138 34 m to the south of town Tuapse. Till 1976 on this site the diffusion of a beach band (average width 6,1 ?)
139 was supervised. Now for the account addition on a beach average width of a beach constitutes 15,5 m, and
140 disregarding zones of dumps average width of a beach on this site remains at a level 1964 year (about 12 ?).
141 Dynamics of beach has distinctive features on separate short sections of beach, especially in zones of beach
142 protective structures and dumps of mined rock. Therefore, with 1956 on 1976 years on 2-3 km of a railway line of
143 Tuapse to Adler was supplemented 116 thousand m³ of rubble that has allowed saving average width of a beach
144 within the limits of 10-14 m.

145 The beach width was reduced on the average from 3 up to 17 m between of the rivers Ashe and Psezuapse for
146 the last 70 years. The broad shingle beaches without variations were saved only to a north from an ostium of the
147 river Ashe during 1 km and to the north of an ostium of the river Psezuapse. Also, they begun to expos to fluid
148 wash per the last years have. Beaches are blurred completely on a considerable extent of beach for last 20 years.

149 The abatement of average width of a beach on a site the river Psezuapse -the river Shahe began with 1950 year
150 and is prolonged till the present time. The beach became already on 12 m for this period. However, variations
151 of a beach were irregular because

152 The rough necessities of the recreational floor space of beaches on the Sochi site for the term of till 2014
153 are indicated below: on an expansion: recreational beaches -88 km, closed -12 km, sum -100 km, expansion of
154 beaches indispensable for recreation -96 km, deficit of beaches -8,8 km; on the recreational floor space of beaches:
155 the existing floor space of a beach -224 ha, floor space of a beach indispensable on wave breaking -320 ha, floor
156 space of a beach, indispensable for recreation, 250 ha, magnitude of a beach deficit -31 ha (Yu.I. Dreizis, 2005).

157 Therefore, basic engineering decision of this problem is the creation or magnification of existing beaches up to
158 the sizes providing complete wave ?clearing at passing of the whole gales. In the created situation, taking into
159 account justified and all increasing draft of the tourists to the Black Sea coast, necessity: 1) keeping of the acting
160 sanitary-hygienic norms of their accommodation, 2) preservation of unique coastal landscapes the demanded
161 recreational progressing of the Sochi site can be provided only at native born variation of adding up practice of
162 resort development of territories. It is necessary to create along a coast band shareware in width not less than
163 100 m (apart from beaches). This band everywhere should be used for green and foot entrances and approaches
164 to this band. To it should flank all coastal protective and hydraulic engineering structures located in an inshore
165 dock space of the sea.

166 3 c) Impurities of the Sochi resort region

167 The hydrological conditions of the Black sea for coast of Russia are those, that the impurities hitting in the coastal
168 zone, are not distributed in a central part of the sea. They concentrate alongshore. The absence of dodges of

3 C) IMPURITIES OF THE SOCHI RESORT REGION

169 impurities carrying by currents can result in to formation of hold-up spots with a high pollutant concentration.
170 The small intensity of water exchange in half-closed coastal dock spaces with the sea, plenty of impurities acting
171 at a coastal zone, makes an inshore dock space by area of a high ecological load.

172 The unfavorable ecological situation is supervised, basically, in narrow 3 km band from the seacoast.

173 Outbursts annually constitute truck -52600 ton/years (dust -2200 ton, monoxide of carbon -39200 ton, nitric
174 oxides -2100 ton, hydrocarbons -8100 ton). The amount of ambulances was augmented from 23015 units in 1980
175 up to 130000 units in 2002. An amount of units of the transport on trunk mains of city -Transport impurities
176 give 75% from all impurities in locale.

177 Stationary sources -10000 ton (sulphurous anhydride -2200 ton, monoxide of Carboneum -2700 ton, hydro-
178 carbons -600 ton). In 1993 volume consisted 7800 ton and in 1986 -5500 ton. There are 31 enterprises in Sochi
179 (food-processing industry -13, domestic and mild industry -4, build construction -7 other -6). The fuel and energy
180 complex constitutes more 300 boiler, from them 60% work on Donetsk coal (high sulphurous -3-4%), 27% on
181 boiler oil, only 5% on gas. 8 industrial enterprises are disposed along the river of Sochi (transport enterprises,
182 base building construction), resetting insufficiently furbished drains in the river and sea.

183 Agriculture -30500 ton -nitrite nitrogen, 1460 ton -nitric nitrogen, 60 ton -ammonium azotes, 19,7 ton -copper,
184 75,8 ton -zinc, 100 ton -pesticides. The common floor space of grounds taken by the agricultural enterprises
185 constitutes 31700 ha (8,9% from territory of Sochi region). Land there are basically in the coastal zone of city,
186 not further 3-5 km from beaches in a north up to 15 km in the south of cities.

187 SPA-hotel complex. There are more 250 recreational establishments in Sochi region, more 120 year-round,
188 remaining seasonal. Only 4% have own refining structures. 60% have own boiler-houses, 50% of boiler-houses
189 is disposed near to recreational zones. The security resting by beaches constitutes -for 55% of the recreational
190 enterprises a load on a beach less than 5 m²/person, for 45% more than 5 m²/person (request of World tourist
191 organization -5-25 m²/person). Load on urban beaches are consist 1 m²/person.

192 Water resources. There are more than 30 rivers of length from 4 up to 90 km in Sochi region. The average
193 modulus of a drain consist 60-70 l/sec with 1 km². The level of contamination of the sea coastal zone In each
194 concrete case of recreational usage of a maritime belt of the sea it is necessary to take into account a depth of
195 water, geology of bottom, parameters of rocks, composing it, alongshore and cross-cut removal of beach detrital
196 deposits existing or anticipated transshipment of a beach band by the tourists over the established specifications
197 etc.

198 It is necessary to consider the extension and creation of beaches within the limits of the Caucasian coast
199 of the Black sea, construction of hydraulic engineering recreational complexes as the basic nature protection
200 measures. The possibility of fluid wash of beaches is eliminated with their help (Yu.I. Dreizis, 2005Dreizis, ,
201 2015, , is interlinked to a level of contamination of the rivers and grounds of site. In Sochi is present 7 «so-called
202 deep district of water use. This spacing interval constitutes less than 2 miles from beaches. The impurities
203 concentrate near to beaches and are distributed alongshore and to it, do not leave on depth. The high bacterial
204 impurity is permanently scored. The coastal waters in district of Sochi and river frequently do not correspond
205 to international and Russian norms (Yu.I. Dreizis, 2005Dreizis, , 2015 The data for the basic types of pollution
206 are given in the table 2.

207 water water issue (depth 8-34 ?), which one are in Table ???: The list of pollutants acting at an atmosphere,
208 in water and in grounds on the average for one year on the Sochi resort region d) Impurity of the Sochi region
209 coastal zone

210 The basic polluters of waters of the given dock space are the household drains and sea trans-port.

211 The level of contaminations of petroleum hydrocarbons in district of ports of Tuapse and Sochi are close among
212 themselves. The average long-term concentrations constitute accordingly 15 x -2 and 11 x -2 mg/l. The absolute
213 maxims of concentrations, disregarding of emergency drowthrows, on these districts reach 13,0 mg/l and 2,45
214 mg/l accordingly. For a period of supervising the average annual concentrations of petroleum hydrocarbons in
215 district of Tuapse were changed in surface layer from 0,05 up to 0,31 mg/l, for bottom -from 0,05 up to 0,26
216 mg/l. The average annual concentrations of petroleum hydrocarbons in district of Sochi are changed from 0,05
217 up to 0,24 mg/l to a surface and from 0,05 up to 0,13 mg/l for bottom.

218 Interannual dynamics of petroleum hydrocarbons concentrations in both districts is characterized not
219 monotonic. The average fluidized on volume concentration, both in district of Tuapse, and in district of Sochi,
220 reaches 2,8 mc (marginal concentrations).

221 The seasonal variability of concentrations is expressed is gentle. The maximum concentrations of petroleum
222 hydrocarbons were supervised in October -November, minimum -in May and August. In the course of the year,
223 first of all, is infringed by appearance of high concentrations in July in both districts, both on a surface, and for
224 bottom.

225 The time-space distribution of petroleum hydrocarbons concentrations in district of studies is characterized
226 by variable nature.

227 The systematic and detailed supervising mirrors a substantial oil painting of impurity of a dock space of Sochi
228 coastal region. The average long-term concentration of petroleum hydrocarbons constitutes in district of Sochi
229 0,14 and 0,09 mg/l accordingly for surface and for bottom of horizons.

230 The waters of Sochi coastal district during studies had also composite hydrochemical conditions. For
231 consequent years of supervising of essential quantitative variations and demurs was not supervised. Two yardsticks

232 should conduct the estimation of ecological state of marine resort locale: ecologically implying state of common
233 impurity of different objects, and applied problem -performances of their suitability for a concrete kind of usage.

234 From the point of view of relevance of recreational resources for economy of marine resort, locale basic usage
235 of a coastal zone of the sea is a beach.

236 For an estimation of quality of these resources, first of all from the point of view of ecological purity, the
237 relevant parameter is water exchange in a coastal zone of the sea. For its estimation, it is necessary to know
238 speeds of alongshore currents permitting to evaluate distribution of impurities in a coastal zone.

239 The ecological status of the Caucasus coast of the Russia can be estimated generally as quite satisfactory. It is
240 essential for reasonable ecologically and economically further development in these coast of resort activities and
241 tourism.

242 Significant increase in content of biogenous substances in a coastal zone is observed usually in places of a
243 confluence of the rivers, at the cities and in areas of ports. The main critical zones of environmental risk in the
244 Black Sea are formed in places of influence of a river drain.

245 To increase of recreational load of beaches and the coast there is an increase in content of biogenous substances
246 in waters of sea coastal zones, cases of the adverse mode on dissolved oxygen are observed. It often is a consequence
247 of the increased content in water of the easily oxidized organic chemistry.

248 Comparison of the obtained data with previous gives the grounds to consider that the tendency of stabilization
249 of level of impurity of a coastal zone remains e) Engineering coastal protective structure in the Sochi region Wave
250 damping wall there are on length of 81 km, beach protective groins -40 km, wave breaking moles -11 km and
251 berm -4,5 km. Thus in a complex these hydraulic engineering structures are executed on an extent only 56 km.

252 As it is visible from stated, the coast of the Sochi site by 1990 was rather saturated with coastal protective
253 structures. It is explained by necessity of protection a resort infrastructure and railway.

254 However, system of coastal protective structures, adding up by 1990, did not ensure reliable fulfillment of
255 coastal protective functions on a considerable extent of beaches. On data of the Sochi Geoeological center,
256 average width of beaches in region was reduced since 1914 on 8-10 m.

257 The analysis of construction and operation of coastal protective structures allows marking their following
258 negative consequences for the coastal zone:

259 The photographs of separate sites of a coastal zone of the Sochi region are indicated on photographs (Fig. 9-
260 28). For creation and the protection of a beach were used various types of coastal protective structures. Efficiency
261 of use of the chosen types of coastal protective designs is various.

262 All above mentioned, and also the development of new methods of the coastal protection, has reduced in
263 comprehension of necessity of development of the new General schema of coastal protective and against a landslide
264 measures (Yu.I. Dreizis, 2005 -the submerged breakwaters do not ensure deduction of beaches without crosscut
265 structures by the way groins. They conduct to deterioration of their stability and worsen conditions of water
266 exchange in summer and reduction of capacity of selfwiping of waters of the coastal zone sharply; -construction
267 of the groin system practiced frequently without filling with an inert material of bays between groins. It results
268 lined to interception of detrital deposits from an alongshore current by groins and to progressing of disastrous
269 low fluid washes; -blocking a dock space by groins also worsens a water exchange and self-cleaning of water in
270 bays between groins; -fulfillment of coastal protective measures in a contingency plan (the outburst on beach
271 of building wastes, concrete blocks of the different sizes and bulk, cross ties etc.) gives void effect. But it also
272 disastrously reduces aesthetic and recreational qualities of coast; rigid regulation of beds of the rivers in an ostium
273 part (the construction of concrete beds) conducts to sharp reduction of a solid drain; the erection close set of
274 wave breaking walls has reduced receipt of detrital deposits in an alongshore current at the expense of a coastal
275 decline abrasion ; the structure of wave breaking walls without beach retaining structures and artificial addition
276 of detrital deposits speeds up fluid wash of a beach band (Yu.I. Dreizis, 2005Dreizis, , 2015, ,

277 4 IV Purposes of the General Coastal Protective Measures 278 Schema Development and Availability of Reasonable Alter- 279 natives

280 The current state of coast of the Black Sea in general can be characterized as unsatisfactory. Now a considerable
281 part (309 km) of coast of the Black Sea within Krasnodar Region of Russia are damaged to abrasion and
282 landslide processes. The situation aggravates a problem of abrasion and washout of sea coast. The general
283 exhaustion of beaches or their absence constrains resort construction. The listed complex of dangerous natural
284 and anthropogenous processes demands acceptance of urgent measures for protection of coast of the Black Sea.

285 Thus, urgent need of development of the program of complex development of resorts of the Black Sea coast of
286 Russia is obvious today. As a prototype of such program, the Concept of formation of a coastal zone of resort
287 recreational system in borders of the resort town of Sochi can be considered.

288 The analysis of the existing condition of the coast of Greater Sochi showed that now on many sites of the
289 coast of Greater Sochi beaches in the between groin compartments and for breakwater spaces have small width
290 or in general are absent. Similar models of strengthening only spoil a coastal landscape and have no advantage.
291 Meanwhile, now almost all coast of the central part of Sochi quite so looks.

4 IV PURPOSES OF THE GENERAL COASTAL PROTECTIVE MEASURES SCHEMA DEVELOPMENT AND AVAILABILITY OF REASONABLE ALTERNATIVES

Without beaches of Sochi cannot take the worthy place among modern resorts. At the first stage, beaches can be created on local sites of 2-3 km in combination with wave canceling constructions. Faltering breakwaters from sketches of a natural stone can yield good results, for example.

The central part of the Sochi coast needs radical reconstruction. Most likely, it is necessary to dismantle monofunctional reinforced concrete designs and to replace them with the constructions providing not only hydrotechnical, but also recreational functions. It is important to have a worthy facade from the sea and the modern wellplanned embankment for the city. It is obvious that without this Sochi, can hardly apply for the worthy post among resorts of the international class. As it was scored above, the coastal zone of Sochi is saturated with the enterprises of a SPA-hotel and transport infrastructure. Thus, the beaches in city boundaries are not only method of beach protection, but also major recreational objects involving in city a plenty of the tourists. So, on accounts of design institute of Hyprogor by 2010, the lump sum loading of beaches of Sochi region could constitute during the high season up to 500 thousand people. Thus, for maintenance of sanitary-hygienic norms the floor space of beaches as contrasted to existing should be enlarged with 180 up to 250 hectares. Thus the coastal protective measures executed according to the adjusted General Schema, were directional on reaching of the following basic purposes: -stabilization of existing shoreline and landslides; -protection of a cloth of the railway against destroying by hurricane wave; -stabilization or extension of existing beaches and creation of new recreational beaches.

The indicated purposes according to the General Schema are reached by realization of particular engineering measures in a coastal zone of the sea.

Key alternative (not in a part of concrete design solutions) considered General Schema, as well as anyone to coastal protective measures, can be only total failure from interference in a course of coastal processes. Width of a dynamical part of a coastal zone (band of beach should be in this case determined, in which one the storm strains are possible) and the prognosis of its strains on a call-off quantity of years (for example, on settlement service life of those or diverse engineering structures, boarding houses, SPA-hotels, communications etc.) is made. After that the recommendations for accommodation of capital engineering structures outside of a dynamical part of a coastal zone are given. In the most dynamical part of a beach, the temporary objects can be located only.

However, such approach merits attention, as a rule, when the complex designing of large objects in a coastal zone from "zero point" is conducted. That is the object is designed on free, not built up and not run in inshore territory. Thus, the floor spaces on the part of beaches are not limited. For conditions of the Sochi region in view of extremely plenty of capital objects in a coastal zone such alternative is unacceptable. Thus, engineering activity, offered in General Schema, key reasonable alternatives are not present.

The main characteristics of the region are provided in table 3 The basic reasons resulting in to exhausting of an ecosystem of the sea are not removed: -the industrial technologies do not answer modern requests in a part of a bionomics. The outlooks on their meliorating as soon as possible are not present; -inefficiently work about half of complexes on clearing of sewages. Their reconstruction, introduction of elements of an after purification is required; -a web of sewer headers in inshore cities and occupied points practically is not developed; -the large part of deep water issues of sewages has damages and requires(demands) recovering with simultaneous magnification of their expansion; -the shower waters from the floor spaces of urbane territories arrive in the sea without clearing.

The considerable influencing on state of a marine environment renders downthrows of pollutants in structure of sewages of the enterprises of a chemical and petrochemical industry, agricultural and municipal services.

Foregone halving of throughput of ports, bound with the geopolitical provision of Krasnodar region in scales of Russia, and the piling ecological situation in country uniquely will reduce in deterioration of a bionomics of the sea.

From total mass of bioorganic matters acting at a marine environment, the greatest share is necessary on municipal refining structures and on a surface drain from the floor spaces of downthrows. Last is the basic polluter of waters by pesticides.

The analysis of outcomes of overseeing by a natural marine environment in coastal areas of the Black sea and, in particular, in district of Sochi region (tab. 1), allows making following conclusions: -for the last five years the quality of seawater was evaluated, basically, II (net), III (moderately contaminated), IV (contaminated) and V (dirty) classes of purity; -the rather stable quality of seawaters valued by the III class of purity was scored in 1991 ; -the tendency to magnification of the pollutions in the coastal zone was scheduled with 1992 on 1994; -the quality of seawaters was improved, that, apparently, is explained by sharp reduction of number resting in 1995, on the contrary.

To basic technique effects on a coastal zone, influencing the railway unconditionally refers. Its activity near to beaches reduces their recreational qualities. Over quality of water exercise influence also navigation and industry of entertainments in a coastal zone.

Middle 80 years were a years of peak load on the Sochi health resort. These years the city accepted up to 3 million tourists for a season. It, on the one hand, allowed receiving the stable incomes, both urban Coastal protective measures, reputed by the General Schema, in case of them technologically realizations by building organizations, will render by exact (according to the projects) following influencing on the parameters of the factors of an environment: -on dynamics of a coastal zone and beach as its component element -positive; -on hydrodynamics of an inshore dock space of the sea -positive; -on quality of seawater in the coastal zonenegative;

354 -on progressing of coastal-marine biocenoses requires padding study; -on forming of coastal-marine landscapes
355 -positive; -on a quality of life and health of the people positive.

356 V. Measures of Software to Prevention of Unacceptable Accomplishment of the Coastal Protection

357 The disorder of the Soviet Union has made the created earlier territorial associations on coastal protection
358 unfit to execute by it functions of the customer, general contractor and operational organization in one face. It
359 has reduced in unbalanced development of offshore coastal strip. The natural mode of coast was infringed; there
360 were disastrous consequences as a result of natural problems. Simultaneously it has provoked losses of recreative
361 valuable inshore territories, economically unjustifiable costs and fulfillment rather expensive compensatory of
362 coastal protective measures.

363 There was a necessity to adapt philosophy of recreational progressing of the Russian Black Sea Coast for modern
364 socio-economic realities, to define the pragmatic approach to development of inshore territories in reasonable
365 combination scientific, ecological, economic, town-planning and engineering decisions.

366 5 a) Existing state of a coastal zone

367 The modern state of the coastal zone is unsystematic, frequently chaotic urbanizing of recreational zones of coast,
368 destroying of existing engineering coastal protective structures and, thereof, degradation of offshore coastal strip
369 as a whole with losses of a recreational potential. Reasons of such state are: -Uniform approach to coastal
370 protective measure too absolutely miscellaneous natural mode sites of coastal zone in the Soviet time; -Heritage
371 of unreasonable solutions on minimization of the costs on alongshore transport mainlines (railway and automobile
372 road); budget, and ordinary to the citizens, but on the other hand result in stressful loads on beaches.

373 -Functionally inexpedient usage of recreative valuable territories;

374 Consequences should be close to an angle diameter of fragments in a natural beach on the given site of beach.

375 2. Used for creation of the artificial beaches the careering material should contain no more than 35 % of fragments
376 of factions (more finely 1-2 mms) and no more than 5% by large surges of large-sized including and to have a
377 high scale of stability to an abrasive wear. The fulfillment of the given item will promote stability of a beach and
378 will reduce up to operations it is necessary to exclude clogging of beaches and of near located territories to them
379 by -Unwarranted construction and seizures of a coastal territory; -The termination of budget and departmental
380 financing of repair and reconstruction of existing hydraulic engineering structures.

381 Outcome of these operating are fluid wash of beaches, landslides, erosion of grounds, destroying non-repaired,
382 non-optimum and of small effective hydraulic engineering structures and their influencing on the beaches.

383 The primal problem, which one faces to the Black Sea cities of Russia, can be formulated as follows: the
384 transformation of an existing coastal zone in a modern recreational megalopolis with the purpose of maintenance
385 is maximum of comfortable conditions for tourists at a high level of investment attractiveness of independent
386 sites of coast.

387 As a result of systematization and analysis of source requests on territory protection, architectural appearance
388 and engineering infrastructure, the following conceptual principles mortgaged in the new complex schema of
389 coastal protection measures were determined (Dreizis Yu.I., 2005 The implementation of a program is expedient
390 for realizing on the basis of regional potential at coordination by Administration of Krasnodar Region, having
391 dissected it on following milestones: 1-st stage-Systematization, generalizing both estimation of efficiency and
392 expediency of available operating time of a regional and federal level. As a result of supervising and scientific
393 studies on the Black Sea coast executed in 1960-1990 years by different organizations, the philosophy were
394 produced, which one should be guided by at realization of coastal protective measures: 1. The angle diameter of
395 fragments of a careering material used for creation of artificial beaches the minimum a mechanical pollution of
396 coastal waters. 3. At fulfillment building of coastal protective sub-standard grounds, building garbage, wastes of
397 fuels and lubricants oils etc.

398 The examples of planned engineering solutions of the Sochi region coastal zone (projects) are given in Fig.
399 29-31).

400 Per the last decades the fissile attempts of creation of a different systems of automation of natural environment
401 monitoring in all branches of engineering activity, bound with interplay of the person and nature are undertaken.
402 To such systems it is possible to refer different types of the automatized management systems (MIS), overall
403 systems of forecasting and management of natural processes (SFMNP), automated design engineering systems
404 (CAD system) etc.

405 As a result of a solution of the indicated general-system problems, the pattern (ASCM) is created, which
406 one basically can be adapted to coast of any tide less pool. natural processes, are the automatized intelligence
407 systems (AIS). Generally they execute following functions: the tax, processing, storage, map, adjusting and issue
408 of the information. In frameworks AIS can be Global Journal of Human Social Science s -Year 2016 software
409 of the intellectual interfacing of the system; -development of the complex automatized system of forecasting and
410 management of coastal processes (CS ICZM); -development of pattern, structure and management system of the
411 automatized databank (ADB).

412 6 VI. Complex Monitoring of a Coastal Zone

413 4. It is necessary to envision for their replenishment, clearing, exportation of garbage, and alignment etc. special
414 technological roads at organization of beaches. They should be powered up together with beaches in the maiden
415 zone of a sanitarian mode. 5. It is necessary to exclude a construction of submerged breakwaters on the coast,
416 where the organization of recreational beaches is realized. 6. It is necessary in all cases to ensure filling again
417 constructed and maintained of between groin bays with an inert material on an unformatted capacity. It should
418 settle up in the concrete projects. 7. The second path of the North-Caucasian railway is necessary be for designing
419 and for plotting only in the party of a land. It is necessary completely to exclude withdrawal of a beach band
420 under the railway. 8. The regulation of beds of the rivers in wellhead sites should be organized on width, not
421 less triple width of a channel, with the purpose of maintenance of the unconstrained passing of a solid drain. 9.
422 It is necessary to be guided by the following rules from the point of view of architectural-landscape designing:
423 -the free beach is the best from all beach protective systems; -it is necessary to prefer structures, not dangerous
424 for bathing, the top which one is disposed below than sea level; -it is necessary to prefer disposition structures
425 in scheduled disposed alongshore and which are not shielding a view on the sea up to horizon; -it is necessary to
426 prefer structures engaging (borrowing) minimum percent(interest) of the floor space of defended offshore coastal
427 strip; -at designing cross-cut structures it is necessary to envision safety factor for construction on them of berths,
428 aerariums etc. with the purpose of provision is maximum of their useful usage; -the constructions, acting above
429 water, should be finished with the special carefulness and to attach them an aesthetic kind. 10. The artificial
430 creation of beaches for the account addition, recommended as the basic method of coastal protection, demands
431 longtime security by an inert material. The delivery of a material from careers is justified in the General Schema.
432 Considering a deficit of an inert material on the Sochi coast and seller's price of its delivery to places of addition,
433 it is expedient to consider a possibility of searches and exploration of an inert material on a underwater decline
434 within the limits of marine depths, where its production is technically probable) and is economically effective.

435 Under the direction of one of the writers the maiden sequential queue of the Automized System of Coastal
436 Processes Monitoring (ASCM) is developed. The maiden sequential queue of the system was developed for
437 the Kaliningrad coast of the Baltic Sea (Makarov K.N., Nikolenko A.?, 1992, 1994). The basic problem of
438 development is the definition of an optimal complex of engineering measures on management of coastal processes
439 by multivariate study of reputed administrative and design solutions. The speech goes about optimization of
440 key solutions on the basis of forecasting change in length of coastal processes strokes. After acceptance of key
441 solutions, their realization can be now projected by traditional methods or with applying of CAD system elements
442 an already available in a design organization. The key solutions constitute a basis of the General Schema of coastal
443 protection.

444 Within the framework of first-order development (ASCM) are decided both general-system problems, and
445 problem of its preliminary adapting to concrete coast. To general-system problems refer: -development of
446 pattern, structure and applicable By information basis of all automized systems of monitoring, forecasting and the
447 managements of -subsystem of data acquisition in field conditions (survey) and its primary processing; editing,
448 storage, map and issue of the information for consequent usage in CS ICZM or immediately by person.

449 It is accepted to call the second subsystem of the AIS as the Automized databank (ADB). Primal problems
450 ADB of seashores are: -maintenance by the indispensable information CS ICZM, and in the long term as well
451 as CAD system of coastal protective measures; -maintenance of user-friendly input, adjusting and information
452 display;

453 -subsystem of input in a computer, transformation, -systematization of available dates on beaches and definition
454 of defects ("holes") in their sets. It allows to organize targeted prospecting operations and by that to save the
455 applicable material means. -The indicated functions are ensured with two principal components ADB: -database
456 that is purely dates on beaches, coastal processes existing structures etc.; -DBMS representing collection of
457 particular software.

458 However, it is necessary to mark, that for final adapting of the designed system and its further information
459 attending it is necessary to organize a complex of special fullscale supervising on sites of coasts, it adapts for
460 which one.

461 It is offered to execute adapting AS ICZM to conditions of coast of the Sochi region that will allow organizing
462 alongside with full-scale supervising, complex automized monitoring of beaches. The international and domestic
463 experience shows that there are many ways of effective protection of coast. Realization of this or that way
464 depends not only on specifically current situation ashore, but also on the planned purposes of use of a coastal
465 zone.

466 At assessment of impact of bank protection constructions on the environment it is necessary to consider
467 consequences (negative and positive), both for nearby landscapes, and for all sea coast in general. When
468 developing shore protection actions it is cause damage to the environment, recreant, or it has to be minimum.

469 To estimate extent of influence of bank protection constructions, actions for strengthening of the coast on the
470 environment, it is necessary to understand the nature of action of the considered means of a coastal protection
471 in the beginning.

472 Creation of beaches in the form of bays is directed to improvement of natural conditions; this nature protection
473 action. On coast with free beaches, free water exchange, which is complicated in the presence groins, is supported.
474 Besides, the beach is not Protection of coast against a wave erosion has to be carried out based on the regularities

475 defining natural dynamics the of litodinamical systems. It is inadmissible to consider a problem of protection of
476 coast as a problem of protection of certain sites of the coast, it has to be solved for all coast, or for several large
477 sites (the litodinamical and coastal systems).

478 In addition, the most important -in the resort area only such design construction decisions that, along with
479 ensuring protection of coast against destruction, will create at the same time the beaches that are actively used in
480 the recreational purposes have to be applied. -qualitative meliorating of functional usage of an inshore recreational
481 zone of Russia Black Sea Coast; -warning of unsystematic building of coast with exception of banal urbanizing
482 territory; -variation of architectural appearance of recreational and urbanizing complexes of a coastal zone by
483 entering of principally new elements; -creation of the district intensive yachting as element of the Mediterranean
484 marine tourism.

485 7 VII. Conclusions

486 necessary to consider that the carriedout works did not only a reliable engineering bank protection construction,
487 but also an additional recreational facility. During creation of beaches, feed by its beach material is necessary.

488 As a result of an implementation of a program the following outcomes will be received: b) Economic -engaging
489 of the off-budget investments; -increase of substantial cost of the land lots of a coastal zone and of near coast
490 territories; -magnification of a commercial effectiveness of operation of objects; -urging of progressing of new
491 industries in locale; magnification of hotel capacitance of coast. c) Social:

492 -creation of new jobs in different orbs; -construction, household service, public catering etc.; -progressing of
peripheral districts of cities and districts; -valuable using of coast recreational resources. ^{1 2}



Figure 1:

493

7 VII. CONCLUSIONS

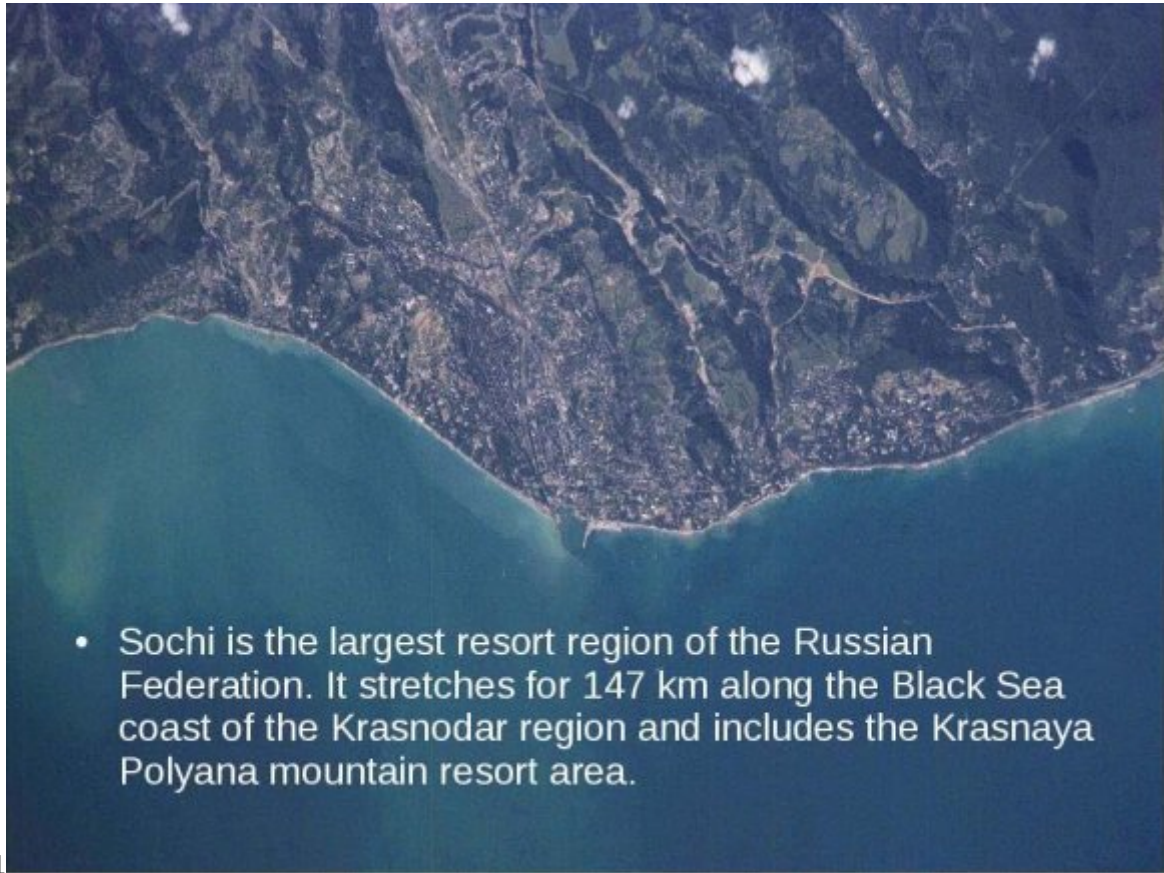


Figure 2: Fig. 1 :



Figure 3: Fig. 4 :



Figure 4: Coastal



5

Figure 5: Fig. 5 :

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67

Figure 6: Fig. 6 :Fig. 7 :

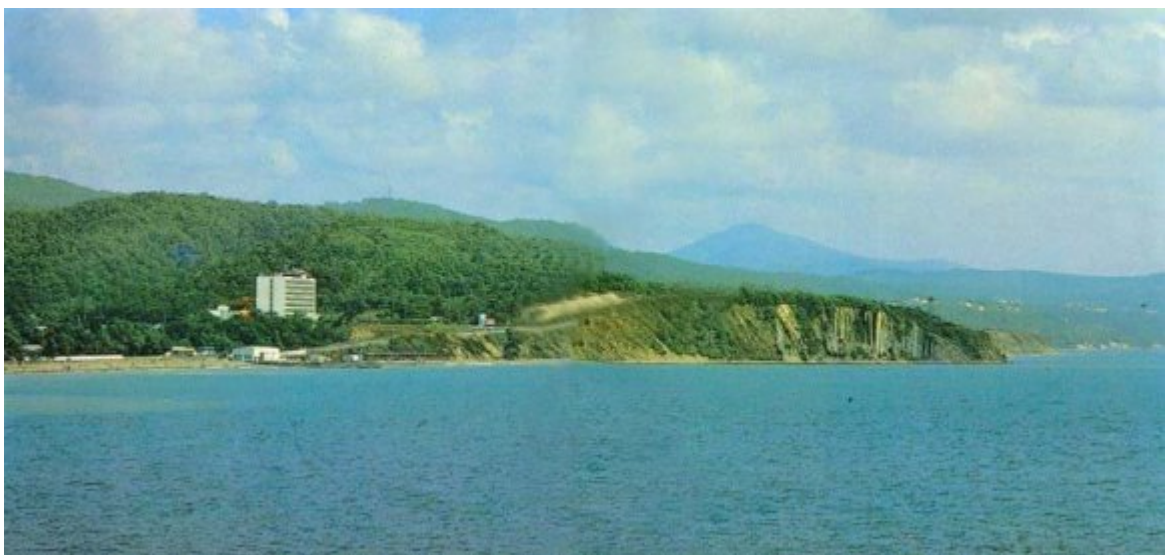


Figure 7: Coastal



Figure 8:



Figure 9:



Figure 10:



Figure 11: Fig. 9 :

7 VII. CONCLUSIONS



Figure 12:



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Figure 13: Fig. 11 :Fig. 14 :Fig. 12 :Fig. 20 :Fig. 21 :Fig. 17 :



Figure 14: Coastal



Figure 15:

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Figure 16:



31

Figure 17: Fig. 31 :



Figure 18:

7 VII. CONCLUSIONS

1

Sites of beach	Expansion, km	Average width, m	Expansion of the beach with average width, m			
			5	5-15	15-25	25
River Tuapse -river Ashe	19,1	15,5	6,8	6,5	5,0	0,8
River Ashe -river Psezuapse	10,5	17,0	2,9	1,3	1,4	5,0
River Psezuapse -river Shahe	16,6	20,0	0,6	4,9	5,5	5,6
River Shahe -cape Uch-Dere	18,1	5	0,7	1,0	3,3	13,
Cape Uch-Dere -river Mzymta	41,0	19,0	2,9	9,4	24,1	4,6
River Mzymta -river Psou	8,2	49,0	No	No	No	8,2
Total	113,5	20,9	13,9	23,1	39,2	37,

Figure 19: Table 1 :

Name	Benzol soot	Benzopiren flakes -from boiler-house and truck 0,5 %	Data's (ton/year) outbursts	2008 year 2,071 are minor	Year 2016 37	Volume XVI Issue V Version I
Formaldehyde	Stiren		36,472	6,669 0,004	(B)	Global Journal of Human Social Science -

[Note: © 2016 Global Journals Inc. (US)]

Figure 20:

3

T

Figure 21: Table 3 :

4

Year 2016
43
Volume XVI Issue V Version I
(B)
Global Journal of Human Social Science -

[Note: s-Year 2016]

Figure 22: Table 4 :

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495 of coast, without which one the organization of valuable and comfortable rest for the sea is represented rather
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